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The Mining Journal

LONDON, JULY 8, 1960

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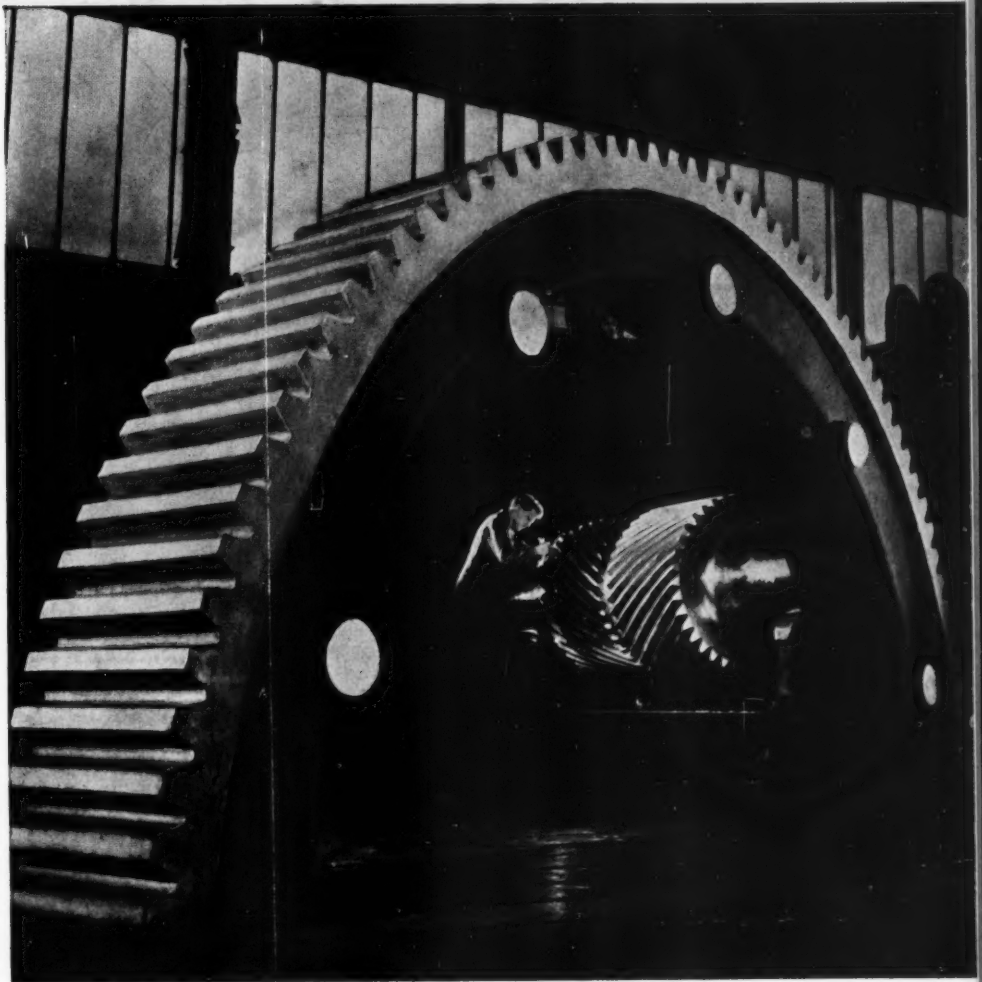
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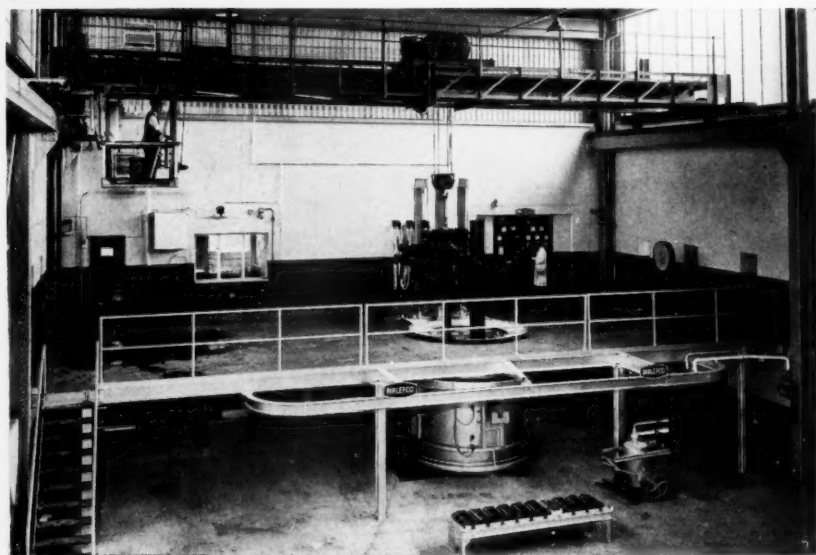
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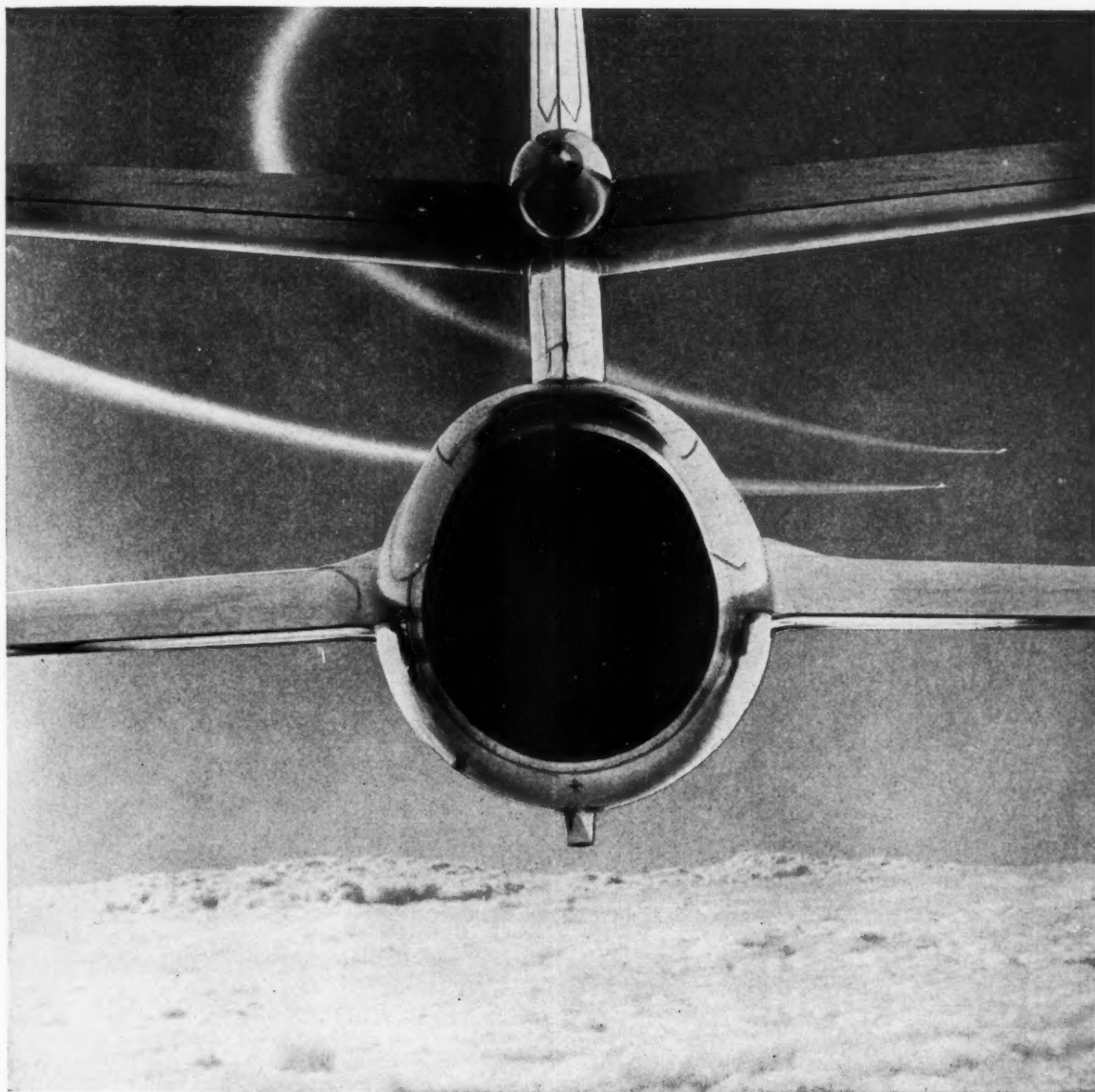
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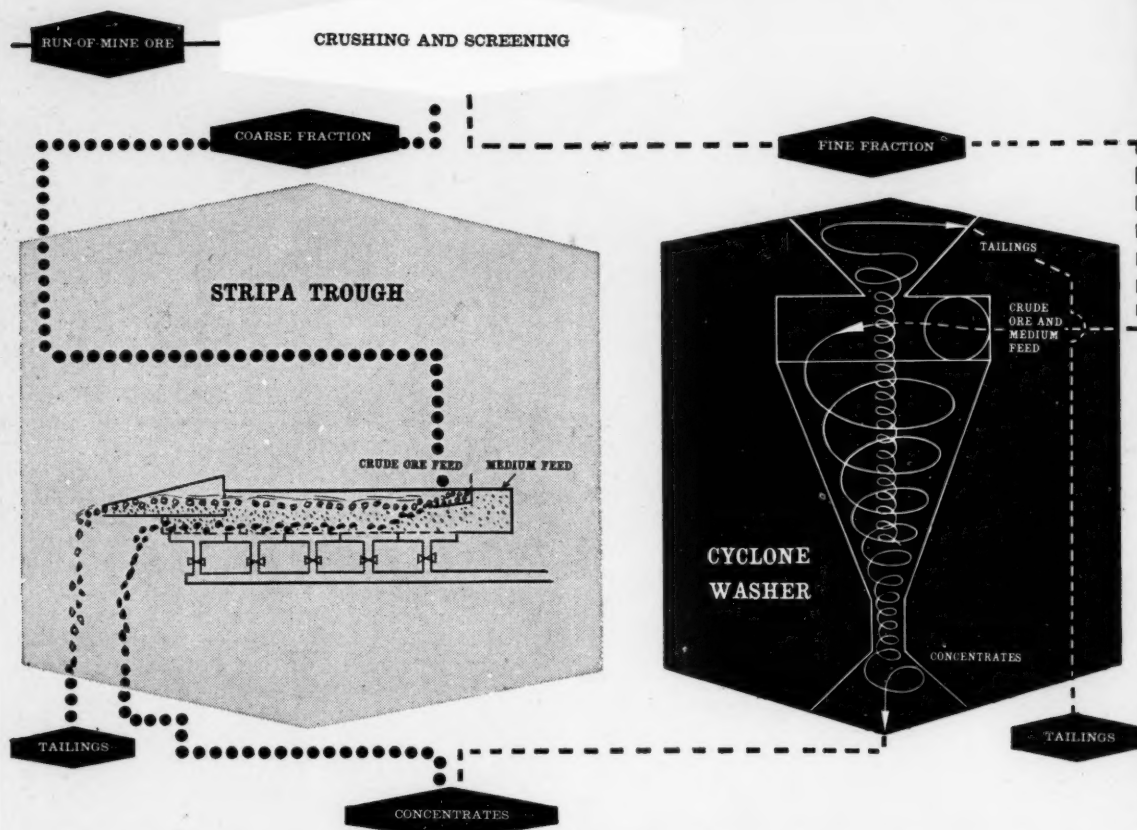
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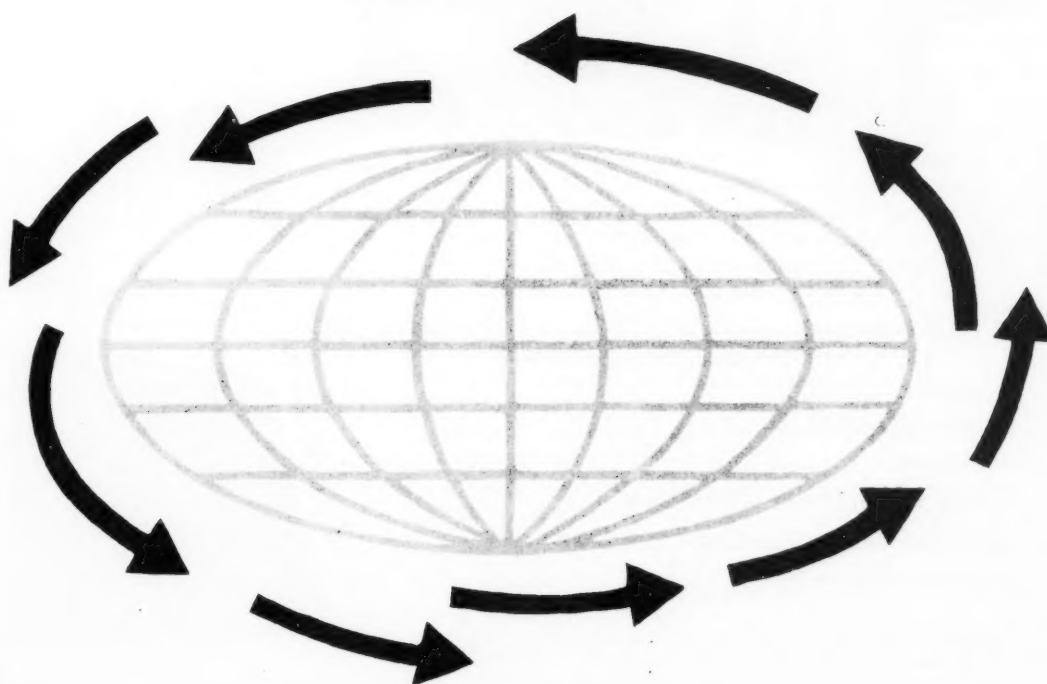
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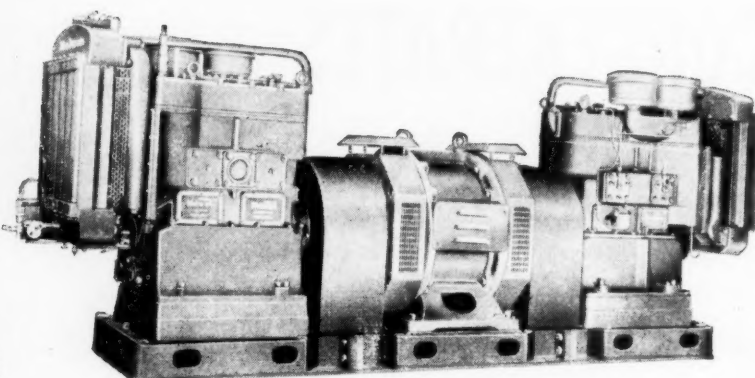
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1950
3500 ft.

600
50
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380 appr.

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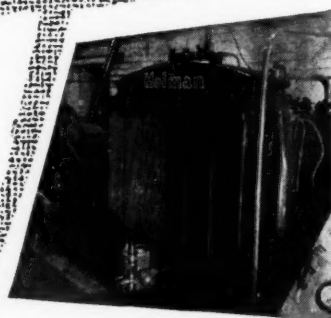
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The Mining Journal

London, July 8, 1960

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The New Tin Agreement

AS expected, the United Nations Tin Conference, after a month of secret negotiations, has resulted in a new tin agreement, which, however, requires ratification by a minimum of 15 countries, including at least nine consuming countries, to become effective. The objectives are defined as being to prevent or alleviate widespread unemployment or underemployment and other serious difficulties likely to result from maladjustments between the supply of and the demand for tin.

Despite some divergence of opinion as to the effectiveness of the existing agreement and the inevitable dissatisfaction of some producer countries with the export quotas, there was never any real doubt that the agreement would be renewed, once such controversial aspects as the size of the buffer stock, the powers of the buffer stock manager, and the distribution of export quotas had been threshed out. However, in the absence of the text of the new agreement, it is still not entirely clear how some of these problems are to be resolved.

Meanwhile, as was to be expected, the chief defect of the present agreement remains—namely that neither the United States, Russia nor China are parties to it. According to a survey conducted recently by *American Metal Market*, tin buyers in the United States are still opposed to an agreement, believing that without one they would almost certainly be able to buy more cheaply on average. On the other hand, they admit that “they can live with” the price maintained under the agreement. Inferentially at least, the Conference seems, however, to have endorsed the Tin Council's view that more was to be gained by not hampering the free working of the tin market in the middle price range than by being oversensitive to the U.S. consumers' views.

There is fortunately no reason to anticipate any change in the attitude of benevolent neutrality which the U.S. Government has consistently displayed, not only by keeping both her strategic and supplementary stockpiles in strict isolation but even by helping to strengthen tin's statistical position through barter off-takes. The collapse of the Summit talks and the Russian walk-out from the disarmament conference underline the improbability of any substantial release of stockpiled tin in the foreseeable future.

So far as the U.S.S.R. is concerned, her relations with the International Tin Council since the crisis of 1958, when heavy exports of Russian tin brought the agreement to the verge of collapse, have been close and co-operative. A Russian observer, Mr. V. S. Alkhimov, attended the United Nations Tin Conference in New York and emphasized his country's desire to promote international tin co-operation as part of a general policy of international economic co-operation. Failing any abrupt reversal of economic policy, Russia can thus be expected to maintain the voluntary limit on exports which it has accepted since the beginning of 1959.

There still remains the anomalous position of China, which,

however, is scarcely likely to pose a problem so long as she continues to export her surplus to Russia. Nevertheless, the time may be coming when she may wish to market more widely.

The operational mechanism of buffer stock and export control in the new pact is similar to that in the current agreement. The maximum size of the buffer stock, however, has been fixed at 20,000 tons instead of at 25,000 tons as in the present agreement. This decision should occasion little surprise, since several producer countries were known to be in favour of reducing their buffer stock commitments. On the other hand, the buffer stock manager has been given powers to borrow on world markets by ordinary commercial means on the security of the 20,000 tons financed by producing countries.

This clause, which represents a compromise between the wishes of producer and consumer members, is designed to give the market greater protection against over-supply without increasing the financial burden on producer countries. How this will work out in practice is, however, as yet far from clear. No doubt the new agreement will be found to have clarified any doubts regarding where title to the ownership of buffer stock tin resides, but even so this is scarcely the type of security that can be expected to appeal to the average banker. Moreover, if the purpose of the loan is to support the tin price when under pressure, the risk of this operation not succeeding cannot be excluded. In the face of such a possibility, to what extent is a banker likely to discount the cash value of the buffer stock? On a commercial basis is it really reasonable to expect him to lend more than about £10,000,000 on the security of the buffer stock (i.e. value the tin at £500 per ton), bearing in mind that the duration of the loan cannot be foreseen as this will depend on how long the buffer stock manager is compelled to carry excess stocks?

On the vexed question of whether or not quota control shall continue in a quota period when there is less than 10,000 tons of metal actually or prospectively in the buffer stock, it would appear that, whatever the intention may have been under the first agreement, the second agreement will be so worded as to ensure that control shall cease. Obviously, this could, under conditions of sudden but temporary tin shortage, result in substantial minehead stocks being suddenly thrown on the market, perhaps just at the time when the temporary shortage was working itself out.

It is not surprising, therefore, that the producers appear to have insisted on a provision whereby control can be re-imposed by the Council if the buffer stock is above 5,000 tons, provided that there has been no control in the preceding quota period. Moreover, there would seem to be a further safeguard in the provision that the figure of 10,000 tons can at any time be revised downwards by a two-thirds majority of both producer and consumer votes.

Maybe this rather cumbersome machinery will work in practice but surely it would make for simpler and smoother operation if the machinery of control, once imposed, were to be kept in continuous being with quotas raised, if necessary, to 150 per cent or more.

The new agreement would appear to envisage no imminent change in the current floor and ceiling prices or in the price ranges between the two. On the other hand it would appear that the powers vested in the council to alter these price ranges during the life of the agreement will apply similarly in the new agreement. It would also appear that under the new agreement the buffer stock manager will no longer have an unqualified duty to sell metal above the ceiling price or to buy it below the floor price. Normally this compulsion will be upon him, but the council will, it is thought, have power to suspend such operations thus giving the buffer stock manager a much needed escape when under the sort of

speculative pressure to which he was subjected in 1958 when Russia suddenly increased its exports.

One further point is that while it is clear that 5,000 tons of tin or cash equivalent is to be returnable to the producing countries, it is not clear whether any of this will in fact be in tin and if so whether it will be deemed to be outside of the operation of the scheme and therefore immediately available to the market. One of the more incomprehensible provisions of the agreement is that on the date of commencement the buffer stock manager shall be required to hold 12,500 tons in metal and 7,500 tons in cash equivalent — no more and no less! On the face of it, it would thus seem that any metal in excess of 12,500 tons which he may be holding at that time must find its way back to the producers.

The percentages of the total export quota allotted to each of the producing countries have been altered, Bolivia's share of the total being cut down from 19.4 to 18 per cent and that of all the others slightly increased. The reduction in Bolivia's quota is presumably due to the rapid fall in that country's production during recent months, as a result of which the existing allowance has not been fully met.

Whereas the current agreement provides generally for voting by a simple majority in the council, the new document provides for most decisions by simple distributed majority (a majority of the votes cast by the producing countries and a majority cast by the consuming countries counted separately). The purpose of this formula is to ensure that decisions are not taken without the general assent of both producing and consuming countries. The agreement provides, however, for a two-third distributed majority on certain important issues.

The producing and consuming groups each hold a total of 1,000 votes — the producing countries on the basis of their percentages and the consuming countries on their average consumption over a previous three-year period.

The new agreement will obviously not be immune from criticism but on the details so far available it does seem that, as indeed was to be expected, the architects of the new scheme have benefited from five years of practical experience and in some important respects the new scheme would appear to be an improvement on its predecessor. Looking into the future, however, there is perhaps one point that we will do well to remember. During the life of the first agreement, the experience of the council was all in the direction of supporting the price under conditions of excess production. We have yet to see how the agreement would operate under conditions of tin shortage.

It may be that such a situation will not arise within the life of the next agreement. Nevertheless, quotas at present stand at about 100 per cent, world ore reserves continue to be depleted and consumption will presumably go on rising — even if slowly.

What happens if there is a shortage? Does the United States intend at that point to liquidate some of its buffer stock and if so is the machinery for doing so sufficiently flexible to enable the metal to be made available in time to steady prices?

AUSTRIAN MINERALS AND METALS OUTPUT

In the first quarter of the current year graphite output in Austria was triple that for the same period of last year. The quarter's output, of 19,100 tonnes reached this high level owing to the commencement of raw graphite use in pig iron production at the country's Donawitz ferrous metals plant.

Iron ore reserves in Austria, it was stated from Vienna, are sufficient for another hundred years; in the first quarter of 1960 iron ore output was 833,200 tonnes, or 7 per cent higher than in the previous year. Great increases were reported in the

production of gypsum and anhydrite—38 per cent over the year to a quarterly output of 151,600 tonnes—and talc and talc shale—up by 33 per cent on the recessionary figure for the 1959 quarter to 15,100 tonnes.

Bauxite production, at 3,600 tonnes, was as much as 50 per cent higher than that in the previous year, and lead-zinc ore output rose by 8 per cent to a 1960 first quarter production of 53,500 tonnes. The tungsten ore mining industry recovered from a recession to settle down with the stabilized output of 1,800 tonnes for the period, while some 3,830 tonnes of antimony ore was produced. Copper ore output fell and at 36,900 tonnes was 8.7 per cent lower than the previous year's figure.

Some 8,500 (8,100) tonnes of machinery for the mining, furnace and building industry was produced in the quarter.

During last year a total of 85,160 tonnes of raw aluminium was produced in Austria, or some 11,000 tonnes more than in 1958. Of this total for 1959 65,726 tonnes consisted of alumina-based primary aluminium. National output of copper and copper alloys for the year totalled 3,450 tonnes. Electrolytic zinc output was up by 8 per cent on 1958 totals to 11,498 tonnes. Nickel production stayed at 1958 levels.

During the year a company in the Tirol began sinter-based production of tungsten, tantalum and molybdenum. Exports of crude aluminium and aluminium semi-manufactures grew in the face of strong international competition, while rolled copper imports fell.

THE OVERSEAS GEOLOGICAL SURVEYS

On Friday, July 1, the new headquarters of the Overseas Geological Surveys at 64-78 Gray's Inn Road, London, was opened by the Duke of Edinburgh. His Royal Highness was welcomed by the Secretary of State for the Colonies, the Rt. Hon. Iain Macleod. After the unveiling ceremony a short speech of thanks was made by the Director of Overseas Geological Surveys, Dr. S. H. Shaw.

The central organisation of the Overseas Geological Surveys was founded in 1947 by the Secretary of State for the Colonies as a practical contribution to the post-war accelerated development of the geology and mineral resources of the United Kingdom's overseas territories. Initially housed in the Imperial Institute building, South Kensington, the headquarters organisation quickly expanded, largely by the absorption in 1949 of the long-standing Mineral Resources Division of that Institute, but also by the creation of new and important specialist branches including those of photo-geology and geophysics. Eventually it outstripped its accommodation and the Colonial Office took the opportunity, in view of the pending demolition of the old Imperial Institute building, of providing modern headquarters with adequate facilities in Gray's Inn Road.

The new four-storey headquarters building is a fine example of contemporary design and planning and houses the specialised technical, advisory and recruiting services that are available for the use of the seventeen geological survey departments in those overseas territories coming under the Secretary of State for the Colonies. Laboratory and technical investigations are carried out for these departments, as well as certain research work; enquiries from government departments, High Commissioners' offices, research and development departments of private firms, universities and private individuals are also dealt with.

The mineralogical section includes laboratories covering the identification and separation of minerals. The chemical laboratories handle rock and mineral analyses and assaying and include a unit for ceramic testing and the investigation of the industrial uses of brick, pottery, refractory and cement-making materials. On the third floor is the magnificent reference library of the Mineral Resources Division containing

50,000 publications, together with a comprehensive card index of about a third of a million items on the mineral resources of the world with special emphasis on Commonwealth mineral occurrences, a statistical section on the mineral industry, and a mining law unit.

The advantages of being able to carry out scientific work in modern premises designed and laid out for the purpose need scarcely be emphasised, and this admirable building should be "an inspiration and stimulus," as Dr. Shaw expressed it, to the Directorate. The Duke of Edinburgh stressed the contrast between the expenditure of roughly £300,000 a year on surveys and the annual value of mineral production of £250,000,000. As he observed, with characteristic understatement, the money was indeed well spent!

It is particularly interesting that the Colonial Office should have seen fit at the present time to provide such greatly improved facilities for an organisation which, by its terms of reference, is concerned primarily with the development of the colonial territories. In the normal way, it is not possible to continue assistance with funds drawn from Colonial Development and Welfare sources after a colony becomes independent. Mr. Macleod, in his speech at the opening ceremony, expressed the hope that, on the basis of payment for services rendered, countries which became independent would avail themselves of the really matchless work done by the Surveys. It is evident, however, that as the number of territories coming under the aegis of the Colonial Office continues to decline, the scope for the Overseas Geological Surveys under the present set-up must correspondingly contract.

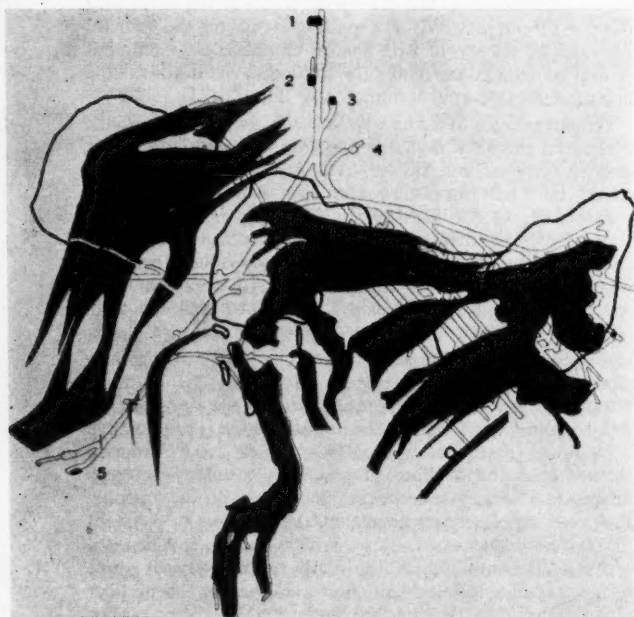
Can it be that the government is not wholly oblivious to the need for a national statistical bureau as a key unit in the formulation of an intelligent minerals policy? The Mineral Resources Division is already one of the leading groups in the field of mineral statistics, with contacts and facilities for gathering and interpreting statistics on a world-wide basis. It would need only a slight change in its terms of reference for the Division to provide the nucleus of a bureau of information and thinking comparable to the national mineral statistics bureaux of other governments—notably the U.S. Bureau of Mines—which, in conjunction with the mineral dressing laboratory at Warren Spring, and perhaps certain agencies in the private sector, could serve as the basis for building a national minerals policy.

IRON AND STEEL IN EASTERN EUROPE

The seventh session of the section on metallurgical raw materials of the Economic Mutual Assistance Council's standing Committee for iron and steel opened recently in Krivoi Rog, the Ukraine. Nikolai Titkov (U.S.S.R.) said that 50 per cent of all iron ore produced in the U.S.S.R. was being dressed and this percentage would be further increased in the next few years. Soviet specialists, he said, had evolved effective methods of dressing low grade ores which had not been used for furnace production in the past. Two large ore dressing plants had been built in the Krivoi Rog iron ore basin, the largest of its kind in the country, where reserves of lean magnetite ores ran into 10,000,000,000 tons.

Up to 10,000,000 tons of concentrate containing over 60 per cent of iron were being produced there from 30 to 37 per cent ores. Industrial tests had been made on enriching by flotation the lean oxydized iron ores of which there are 50,000,000,000 tons in the area.

By 1965, four more large ore dressing plants would be put into service in the Krivoi Rog basin, he said. One of them, the central plant, would process up to 24,000,000 tons of low grade ore a year. Ore dressing mills with an annual capacity of 36,000,000 tons would be put into operation elsewhere in the Soviet Union.



FORMING part of a scheme of the Grängesberg Co. to revive the Bergslaget mining district in Central Sweden with part of the funds received from the government, when the latter exercised its right to redeem the shares in the Luossavaara-Kiirunavaara companies owned by Grängesberg, the Strassa mine was re-opened October last after having been in disuse since 1923.

Technical advances in mining methods and improved dressing techniques have again made mining at Strassa worthwhile and this old Central Swedish iron mine has been re-equipped with what is claimed to be the most modern mining machinery in Europe.

Located in the district of Ramsberg, about 40 km. south of Grängesberg, the Strassa orefield is connected by a 7 km. branch line with Stora station on the Oxelösund railway. After Grängesberg, the Strassa orefield is the largest single ore deposit in Central Sweden. The ore is of the somewhat lean type, rich in quartz, and is similar to that found in a number of the major Central Swedish mines such as Stripa and Norberg. With an iron content of 36-37 per cent, and low in phosphorus (0.017 per cent), the ore is of a type that cannot be used on any appreciable scale without previous concentration and every ton of

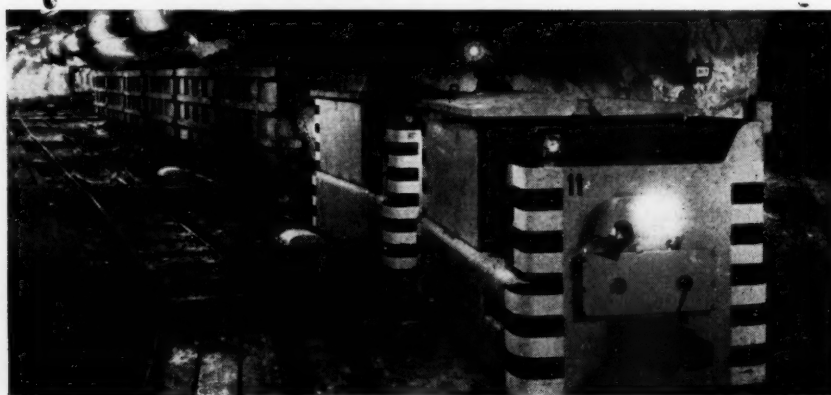
RE-OPENED GRÄNGESBERG

concentrate requires 2.2-2.3 tons of crude ore. This involves a high cost of production, but the concentrate can achieve as high an iron content as 70 per cent (magnetite ore) or 56-62 per cent (hematite ore) with the percentage of phosphorus standing at only 0.005 per cent.

By the time the mine had been closed down in 1923 after only six years of operation by the Grängesberg Co., because of the slump which followed the First World War, a total of about 1,000,000 tons of this high grade concentrate had been produced. When mining operations were discontinued at Strassa in 1923, drainage was carried on for a further ten years. Pumping was then stopped and the mines were allowed to flood with water. Pumping operations were recommenced in 1955.

The Strassa field consists of a complex of three large orebodies of irregular shape which have been worked as open-cast mines by the names of Storgruvan, Nygruvan and Ostergruvan respectively. Under present conditions, however, underground mining will be most suitable and the output from the mine is estimated to be about 1,100,000 tons per annum, making it the fourth producer in Sweden, with ore reserves at present calculated to last for at least 100 years. The ore holds 80 per cent magnetite and 20 per cent red iron ore, this calling for the use of several kinds of concentration methods. The Grängesberg development scheme is, in fact, a tight-fitting arrangement of mining, enriching and processing at new and modern plants, including an iron works with an initial capacity of 300,000 tons of finished plate per annum. The latter is now on the point of completion at Oxelösund on the Baltic Coast, south of Stockholm.

Extraction of the thick block of ore between the 80 m. level and the bottom of the open pits at the 30 m. level will be achieved for the most part by sub-level benching operations. From the head of a drift in the footwall, cross cuts will be driven every 25 m. to the hanging wall. Drifts will be made between the cross cuts, and from these 25 m. long inclined holes will be drilled fanwise to be joined by holes of equal depth driven from the bottom of the open pit. Every round is expected to yield about 15,000 tons of ore and following blasting the ore slides down the slanting walls for loading. This yield per round corresponds to three days' full production. Of the two shafts, the North



Above, at left, general layout of the Strassa mine with shaded areas representing the orebodies running generally in a W.-E. direction at the 80 m. level. The ringed areas represent the open-cast mines. 1, the North crushing station, 2, South crushing station, 3, North shaft, 4, dynamite store room, 5, South shaft. Alongside, at left, ore train on the 80 m. level

GESBERG STRASSA MINE, SWEDEN

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and South shafts, the former will be used for bringing the ore to the surface.

A new type of Atlas-Copco drilling rig uses 6 ft. Coromant extension steels for bench driving from below the outcrops in the V-like upwards-and-outwards pattern mentioned. These upward holes may be as much as 100 ft. deep, though generally the depth runs to about 80 ft. and varies with the degree of incline of each particular hole. Each hole has a diameter of 2 in.

Known as the BUX 35, the Atlas-Copco drilling equipment has been under test in the Strassa mine for several months. The head part of the equipment consists of two screwfeeds BMS 66 and two drilling machines BBC 52X. Both machines are used to drill the fan-shaped pattern, one drilling the left hand side of the fan and the other the right hand side. One man handles both the machines, producing an average of 400-500 ft. of hole per 8-hour shift. The maximum result obtained up to January 1960 was 750 ft. per shift.

The rock drills are mounted on a specially designed drilling jumbo which ensures a firm support. At the same time, it permits the important process of aligning the drill holes to be carried out simply and quickly. Transmitting the impact from the rock drill to the tungsten-carbide 4-point bits at a rate of many thousands a minute are 1 in. hexagon chrome molybdenum steels in rods of 6 ft. length. Each rod is joined by means of a coupling sleeve which has a female rope thread. The extension rods have a corresponding rope thread at each end. This thread is designed in such a way that, while it is easy to couple up and detach, it provides a very good transmission of the impact force from rod to rod. This is of considerable importance when there are some 15 lengths of steel and connection rods in the hole.

Production at the Strassa mine will be about 450,000 tons of ore concentrate, with an average of 65 per cent Fe content per annum.

Expansion at the Oxelösund iron works of the Grängesberg Co., which was decided upon in 1957 and is now nearing completion, involves a substantial increase of capacity within the present production programme and the working up of the iron for two further stages. Most of

the pig iron, hitherto the end product, will be converted into steel and the steel will be rolled to heavy gauge plate.

Pig iron output is to be increased to 430,000 tonnes per annum from 120,000 tonnes before expansion, and a new blast furnace with a capacity of 1,000 tonnes per 24 hours, will help to accomplish this. It will be the biggest in Sweden. The size of the coking plant will be almost trebled, from 125,000 to 340,000 tonnes of coke per annum, and the by-products plants will be correspondingly expanded.

The steelworks will have an annual capacity of about 430,000 ingot tons. It will convert the pig iron to steel in large, fast-rotating cylindrical converters, each capable of holding 100 tonnes. In these, the iron will be treated with pure oxygen by the new Kaldo process. Some steel will also be produced in Siemens-Martin furnaces by the open hearth process. Plate will be rolled to a final thickness of 6-50 mm. (0.236-1.97 in.), a maximum width of 3.3 m. (10 ft. 10 in.) and a maximum length of 23 m. (75 ft. 6 in.), though the finished plate will be normally cropped to a length of about 12 m. (40ft.).

On completion, the works mines and offices will have some 2,500-3,000 employees.



Above, at right, blasthole drilling in the Strassa underground mine at the end of 1959. The new Atlas-Copco equipment is being used. Below, at right, alongside, is a general view of the Strassa mine as at October, 1959. Technical advances in mining methods and improved dressing techniques have once again made mining operations at Strassa worth while



Northern Canada—II

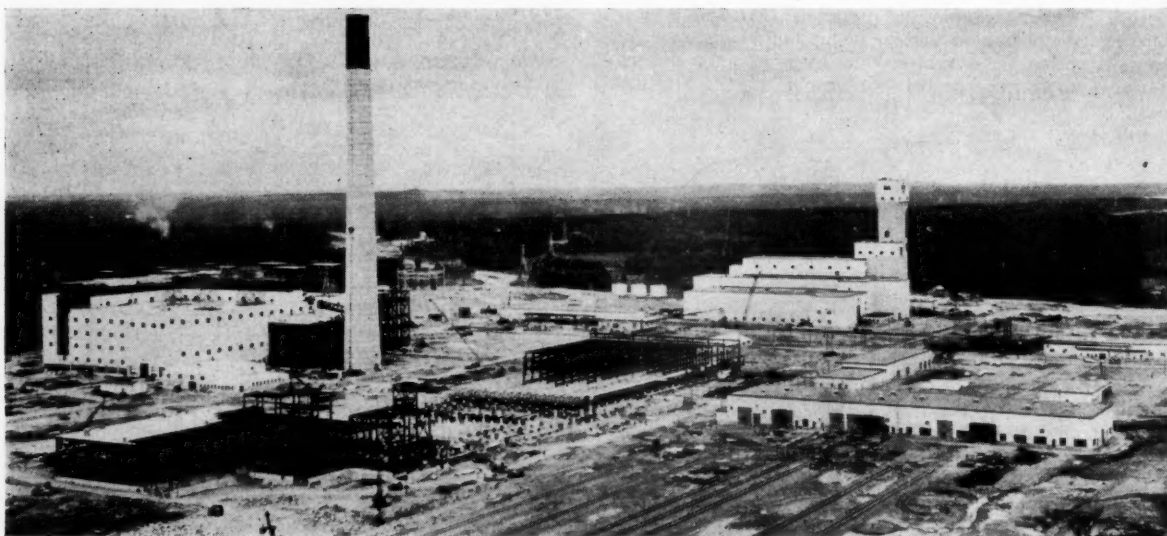
Economics of Exploiting Northern Canada

ASSUMING a base metal operation on tidewater in Hudson Bay, and producing a concentrate at a ratio of 7 : 1, the report assesses a total increment owing to water plus rail freight of \$14.50, or over \$2.00 per ton of ore mined. This is made up of \$7.00 per ton water freight to Churchill and half the Churchill to smelter rail freight of \$15.00 per ton. Further assuming justifiable road haulage from an inland mine to the tidewater, this is assessed at 10 cents per ton-mile and with a concentration ratio of 7 : 1, this would represent an additional charge of 1.5 cent per ton against the ore mined.

The European market is mentioned in the report as a logical market for Canadian Arctic mineral products, especially should European consumption trends continue beyond the requirements forecast in the Paley report. Whether or not Hudson Bay and other northern waters could be made economically accessible to intense summer shipping remains to be seen, but low-cost inland winter roads may merit consideration.

In the Central Access Division, a measure of transportation costs to the Yellowknife area is made by reference to those of Consolidated Discovery Yellowknife Mines Ltd., which is the only N. Canadian mine that has to rely on air service alone over a portion of its supply route. Total average freight rates paid by this company to Edmonton in 1958 were \$85.00 per ton, made up of : rail freight, Edmonton-Waterways, \$21.00; water freight Waterways-Yellowknife, \$33.50 ; air freight Yellowknife-Discovery, \$30.50. Freight alone to Edmonton was about \$2.20 per ton mined; with handling and warehouse charges \$2.75 per ton mined. The latter figure is considered low since no allowances have been made for some freight deliveries by smaller than Bristol Aircraft at higher cost.

General view of the Thompson, Manitoba, site of the International Nickel Co. of Canada Ltd., showing the 500-ft. chimney and steel skeleton of the quarter-mile-long nickel refinery rising in left foreground. The smelter, left, is rapidly becoming closed in. To the right are the mill and the headframe of the Thompson Mine production shaft. In foreground are service buildings. The development of the Thompson enterprise is symbolic of what can be achieved in Canada's northlands



The published air freight rate of \$30.50 per ton from Yellowknife to Discovery is about 60 cents per ton-mile. Were a new 140 tons per day gold mining operation to begin, say 175 miles from an established centre such as Yellowknife and off the water route, with incoming freight at about 1,200 tons a year, air freight charges would work out at about \$2.78 per ton mined. Adding to this \$1.00 per ton mined for the Edmonton-Yellowknife increment the total would approach \$4.00 per ton mined, with still no allowance included for the comparative remoteness of Edmonton from the major markets.

This assessment would apply only to gold mining. Base metal concentrate production would involve increased south-bound freight and for uranium the north-bound freight requirement, at least, would be very large. Even at low bulk rates, sulphur transportation for the acid-leach process alone would be expected to cost about \$0.25 per ton mined.

Transport Subsidiaries and Hydro-Power

Several producers save transportation costs by operating their own transport subsidiaries. In one case, air freight Beaverlodge-Edmonton has been reduced from 12 cents to 5 cents per lb. and passenger fares from \$37.00 to \$12.00.

Transportation to and from the Dawson-Mayo areas of the Western Access Division will be facilitated by completion of the Yukon River bridge and of those under construction over the Stewart and Pelly Rivers.

In the case of the operations of United Keno Hill Mines, which are given in the report as an example of transportation charges to and from this division, the cost of shipping concentrates from Elsa to Whitehorse, about 300 miles, works out at \$4.50 per ton mined and all this part of the journey, at any rate, is considered to lie within the range of the northern excess increment. For all northern base metal producers, the shipping-out of concentrates is regarded as the largest single item chargeable to northern location.

her Canada's Minerals

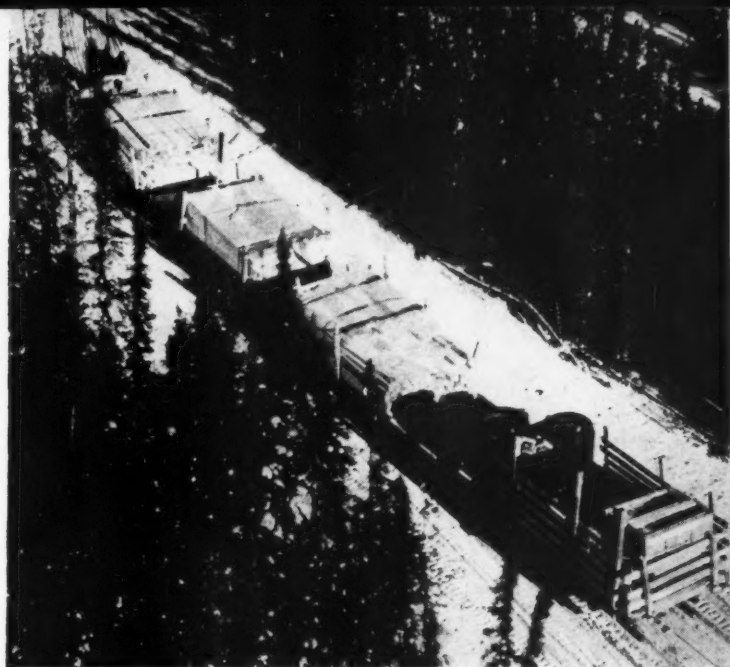
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what extent and in what way additional costs attributable to location, compared with more southerly parts of Canada, affect mineral development in Northern Canada has recently been discussed by Amil Dubnie in a report published in December 1959, by the Mineral Resources Division, Department of Mines and Technical Surveys, Ottawa, entitled "Some Economic Factors Affecting Northern Mineral Development in Canada"



A "Snowball Express" tractor freight train operating on Inco's Moak-Mystery Lakes project

Surveys of northern power resources have shown the hydro-electric potential to be adequate for the foreseeable needs of the mineral industry. The largest potential site in Eastern Canada is believed to be that on the Hamilton River, south of latitude 55 deg. N., which shows a potential of over 4,000,000 h.p. Exceptionally large installations are believed to be possible on the Nass River, B.C., and on the Yukon River and its tributaries in the Yukon Territory. The potential of the latter may surpass 4,000,000 h.p. with maximum utilization. The Northwest Territories has a minimum reserve of 375,000 h.p. No exceptionally large installations are believed possible.

Hydro construction to serve one isolated producer can hardly be justified except under ideal conditions and with a view to long term operation. Such producers usually rely on diesel-powered generators. Large-scale hydro-electric plants may be justifiable when serving a large-scale operation or a group of smaller operations. For instance, the Northern Canada Power Commission at Snare River effectively serves the Yellowknife mines and other users at favourable power costs. Less effective and more costly is the Mayo River system supplying one major user, United Keno Hill Mines, and only minor local power consumers.

At the North Rankin Nickel Mine diesel-generated power works out at \$2.00 per ton mined. Electricity costs at other selected mines using diesel-generated or purchased hydro varies between 1.10 cents per kWh and 2.625 cents per kWh, without including the depreciation factor for diesel plants or cost of maintenance and operation in the case of purchased power.

Maintaining a Labour Force

Another major problem facing northern operators is that of maintaining adequate labour and special incentives have to be offered. Most of the labour required in the northwest is recruited through the Alberta and Northwest Chamber of Mines and Resources. During 1958, the Chamber of Mines and Resources filled 2,200 applications for member companies, most of these being for skilled miners, though many would also return to former employment without passing through the Chamber. In the east, the mines obtain their labour through newspaper advertising and through employment agencies. Northern labour turnover varies generally between 50 and 200 per cent per annum.

From records of actual cash expenditures by companies, an increment of \$0.25 to \$1.65 per ton mined for labour can be shown. The average for a group of representative mines, where

reasonably complete records were available, amounted to \$0.70 per ton mined. This included subsidies for labour transportation, for boarding, married housing, heating and recreational facilities. Adding to this an increment for bonus payments, a labour increment of \$1.00 per ton mined is arrived at as a fair order of magnitude.

Although the size of the increment for special heating under northern climatic conditions hardly compares with those for transportation, power or labour, it is considered most likely to remain as a permanent feature in the northern cost sheets and has been assessed at \$0.20 and \$0.27 respectively for two mines investigated.

For a given capacity, capital investment in the northern mining plant and camp facilities is greater than in the south, since most costs are higher as a result of the increments already mentioned. One producer referred to in the report, located in the Cordilleran region, has invested about \$6,000,000 for a mining capacity of about 165,000 tons a year, 38 per cent of this being chargeable to investment in facilities for employees.

Capital investment increments have been quoted in the range of 25 to 100 per cent, but the norm is probably about half way between these extremes. A comparison of costs of two major Saskatchewan uranium producers with a combined 4,000-tons-per-day capacity with those of a representative group of producers in Elliot Lake with a combined capacity of 10,500 tons per day showed the capital investment increment for the northern plants to be about 50 per cent, though differences in mining and milling methods necessitated some qualification of this result. An interesting point about the Elliot Lake plants was that the southern location actually contributed to labour mobility and turnover at a critical stage of development.

By applying the increment figure of 50 per cent to records of capital investment as shown in annual reports, a low figure of \$0.65 per ton mined can be charged to interest at 6 per cent on capital increment at one major producer, whereas a high figure of \$1.25 per ton applies at a small operation. Although precise determination of this factor is difficult, the figure applying to most producers seems to tend rather toward the upper bracket than the lower and is likely \$1.00 on average.

Northern cost increments on money invested in stores and supplies vary considerably and a fair assessment could be within the range \$0.25 to \$1.00 per ton mined depending on the location of the producer and the type of process.

Vanadium

A Metal with A Future

VANADIUM, in the form of ferro-alloys, has been serving the steel industry since 1896. Interest in the pure metal lagged, however, since it appeared that vanadium lacked ductility; but it is true of the reactive group of metals that decreasing their impurities to extremely minute fractions produces many unusual properties. When, for the first time, this high purity was achieved with vanadium in 1927, the researchers were rewarded with a few small pieces of pure vanadium wire. They were more than satisfied, however, because those fragments of wire proved that high purity gave vanadium the sought-after property of ductility.

The results of the experiment were not repeated for a number of years. Then, in 1949, after many years of extensive research and painstaking investigation, Union Carbide announced that it was able to produce pure (99.8 to 99.9 per cent) ductile vanadium in commercial quantities, and in forms suitable to industry—melting stock, plates, bars, wires and foil. Since then there has been a sharp increase in sales, which tripled between 1951 and 1956. Much of this added interest is due to increasing recognition of the potential of the pure metal.

Before important uses for ductile vanadium can be forecast, some of its properties must be kept in mind. These properties vary appreciably with the oxygen, nitrogen, hydrogen and carbon content of the metal as well as with the amount of cold working which the metal undergoes.

Vanadium has a lower density than that of steel, but its elastic modulus is high with respect to its density. Thus its modulus-density ratio is about the same as steel. The



Cold reductions of up to 90 per cent without intermediate annealing can be made in rolling high-purity vanadium. This article is condensed from "Metals Review", published by Union Carbide Corporation, United States

metal is resistant to reducing acids but not to oxidizing acids and is highly resistant to corrosion in salt spray atmosphere and seawater. It has negligible magnetic susceptibilities. Any machining procedure suitable for cold rolled steel will apply to ductile vanadium. The metal may also be formed at mildly elevated temperatures and welded under argon shielded or argon atmospheres using a Heliarc Torch.

Ductile vanadium retains a useful proportion of its strength (about 15,000 psi [1,054 kg./cm.²]) at a temperature of 1,650 degrees F. (899 deg. C.). Vanadium-base alloys have been tested up to 1,550 degrees F. (843 deg. C.), and show strength in the range of 70,000 psi (4,921 kg./cm.²). Vanadium also has good thermal conductivity. The pure, ductile metal also has unusual properties in the nuclear field. It resists forming brittle phases with uranium fuel alloy and it has a moderately low neutron capture cross-section.

Ductile vanadium could be the choice for a structural part in which flexural rigidity is the primary consideration. It could also be the choice for instruments or parts subject to dynamic stress on ships and in other salt air environments. In the field of electronic applications, vanadium could be considered for X-ray cathodes, precision resistors and thermocouples. Already it is being used in a new ferromagnetic alloy with excellent properties for miniaturized transformer cores and magnetic amplifiers.

Perhaps the largest potential, however, is in the field of atomic energy. Here vanadium may be used to replace zirconium as a thin-walled tubing to clad the uranium fuel elements as the operating temperatures of the newer fast-breeder reactors are raised to achieve greater efficiency. Vanadium is being considered for this role because it does not form brittle alloys with uranium, and because it also strongly resists the corrosion of the liquid sodium coolant used in such reactors. In other parts of the reactor, vanadium-base alloys may be used because of their good elevated temperature strength properties.

Properties of Vanadium Metal

Atomic number	...	...	23
Atomic weight	...	...	50.95
Crystal structure	...	...	Body-centred cubic
Density, grams per cm ³	...	...	6.11
Melting point, degrees C.	...	...	1,710
" " degrees F.	...	...	3,186
Coefficient of expansion, in./in./deg. C.	...	...	8.3 × 10 ⁻⁶
Electrical resistivity, ohm/cm.	...	...	24.8 × 10 ⁻⁶
Modulus of elasticity, psi (kg./cm. ²)	...	...	19 to 20.5 million (1.3 to 1.4 million)
Tensile strength, psi (kg./cm. ²)	...	...	60,000 to 75,000
hot rolled and annealed bar	...	...	(4,220 to 5,270)
cold rolled strip, 75 per cent	...	...	112,900 (8,010)
cold rolled and annealed strip	...	...	70,000 to 75,000 (4,920 to 5,270)
Typical chemical analysis			
carbon	...	...	0.05 per cent
oxygen	...	...	0.07 " "
hydrogen	...	...	0.01 " "
nitrogen	...	...	0.05 " "
vanadium	...	...	99.8 plus per cent

Technical Briefs

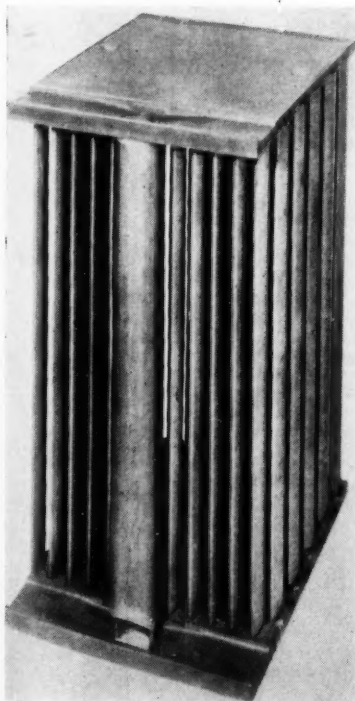
Flotation of Low Grade Mercury Ores

The U.S. Bureau of Mines reports (R.I.5598) that most ores of mercury are amenable to concentration by flotation.

Five types of ores were studied and all found to be amenable but the intimate association of the mercury with gangue minerals required fine grinding in most instances limiting the amount of mercury recovered. Over 90 per cent of the mercury could be recovered from ores containing 0.5 per cent Hg or more but fell to about 80 per cent on lower grade material. As far as grade of concentrate is concerned, with high grade sample types of ore, a minimum of 10 per cent could be achieved but a grade of less than 5 per cent only was possible with low grade complex ore types.

Satisfactory reagents are very similar to those used for other sulphide minerals. A small amount of the mercury sulphides would float without activation, most of the cinnabar and all the meta cinnabar requires activation. The effect of such activators as copper sulphate or chloride and lead salts was not so well defined in the flotation of cinnabar as in the flotation of meta cinnabar and the most noticeable effect on the cinnabar was the shortening of flotation time but no definite increase in recovery was indicated. On the other hand, with meta cinnabar activation was necessary to obtain flotation.

Entrainment separator modules of impervious graphite



The Bureau of Mines have also made a study of the effectiveness of several flocculants to improve the characteristics of hydraulic back fill (R.I. 5597) since impervious layers of slime sometimes separate and settle out on top of the sand fill and if this slime could be flocculated and disseminated throughout, the percolation and settling rates should be improved. The tests indicate that polyelectrolytes, particularly Separan 2610, Aerofloc 3000, Aerofloc 3019 and Guartec FX generally are more effective than trivalent, divalent or monovalent salts which are often used as flocculants.

An interesting viscometer for use with mineral suspensions has been described in a bulletin by the Mines Branch, Dept. of Mines and Technical Surveys, Ottawa. (*A Viscometer for Mineral Suspensions*.) The apparatus consists of a modified falling-ball viscometer in which a plummet is pulled vertically through the slurry under test at a rate governed by an external weight and the velocity of the plummet established by means of two Geiger tubes which are actuated by a small radioactive source inside the plummet.

Using suspensions of glass spheres, barite and galena, the viscosity was compared at different rates of shear and the apparatus is said to be capable of measuring viscosities ranging from 100 to 500 centipoises at rates of shear of from 100 to 1,000 reciprocal seconds. Furthermore, since the stress is constant, and fresh material is always being sheared throughout any one measurement, the viscometer is well suited to the determination of the rheological properties of thixotropic fluids.

MODULAR ENTRAINMENT SEPARATORS

Entrainment separator modules made of impervious graphite for effective separation of entrained liquids from corrosive gas streams are now available from Carbon and Graphite Department, Union Carbide International Co., Division of Union Carbide Corporation. Designed for high collection efficiency and low pressure drop, the corrosion-resistant modules measure one by 2 ft. (30.4 by 60.9 cm.) and can be easily assembled into banks to fit any duct or process vessel.

Type MV entrainment separator modules are of unitized construction, and operate on the principle of impingement plus venturi action. Staggered rows of tear-drop-shaped Karbate impervious graphite rods are cemented in place with a minimum of $\frac{1}{4}$ in. (6.3 mm.) clearance to minimize clogging. The staggered arrangement prevents straight-through flow, and the open diagonal lanes permit easy cleaning when necessary. The streamlined rod shape retards re-entrainment and minimizes resistance to gas flow.

Modules are available in two styles: style A is used in single-row entrainment separators or as the top row of larger assemblies; style B units for the lower rows have a gutter and downcomer to provide positive drainage of the liquid separated from the gas by upper units.

Side plates for both styles provide proper fit to the wall of the containing vessel.

Approximate capacity of one module is the same as that of a 20 in. (50.8 cm.) line-type entrainment separator. The number of modules required for a given application can be determined by dividing the total gas flow by the capacity of one module, calculated from the nomograph in catalogue section S-6900.

Additional information on modular, type MV, entrainment separators is available from the Carbon and Graphite Department, Union Carbide International Co., 270 Park Avenue, New York 17, N.Y., United States.

PROTECTIVE COATING FOR FERROUS METALS

A new protective coating which can be applied to ferrous metals and their alloys, and which is said to be exceptionally resistant to erosion even at very high temperatures, has been developed.

The coating is said for example, to have retained its toughness at temperatures of up to 900 deg. C. At the same time, the compound is said to have good adhesion to the base metal to which it is applied and to provide exceptional protection against corrosion and other similar forms of destructive attack.

The new coating is said to be particularly effective when applied to ferrous metal alloys containing chromium. It is made by applying a zirconium-rich alloy, powdered zirconium, or zirconium hydride mixed with an evaporable organic liquid binding material to the cleaned metal surface. During the process of application the metal must be heated to a temperature of at least 900 deg. C. either under vacuum conditions, or in an inert or chemically non-reactive atmosphere. During the application process, the zirconium diffuses into the metal and the coated metal must be allowed to cool under the same vacuum, or inert atmospheric conditions, under which it was applied.

The new coating process is expected to find widespread applications in the fields of mechanical engineering, nuclear engineering and chemicals where high temperature operating conditions are encountered coincident with abrasion and corrosion problems.

NEW SILICONE GREASE

A new silicone grease, M.494, has been added to the rapidly growing range of I.C.I. Nobel Division silicone products. The outstanding electrical qualities of M.494, coupled with the silicone characteristic of intense water-repellency, give it exceptional efficiency as a sealing agent for electrical equipment, and as a general agent to protect surfaces against moisture.

Technically and economically, M.494 has proved its worth in many specialized and varied applications which include: protection of insulations from corona discharge; sealing and potting grease in electronic equipment; lubricant for electric cable prior to its being drawn through conduits, harness, etc.; release agent in moulding and casting operations; packing grease for glands and for impregnating asbestos packings to prevent sticking of joints; glass stop-clock lubricant; lubricant for preventing sticking of screw threads, e.g. with electric fittings located outdoors; vacuum sealing grease.

MINING MISCELLANY



A Terylene-cotton conveyor belt, with special rubber covers compounded to resist sea air and water, running in a limestone quarry in the West Country. Made by Barrow, Hepburn and Gale Ltd., the belt is 950 ft. long, and was made endless on site. Terylene was chosen to provide a belt of extra strength, increased impact resistance, and flexibility, to work under arduous operating conditions

Research workers at the Bureau of Mines U.S. Department of the Interior have discovered that the rare chemical coronene can be produced during the conversion of certain American coals to pipeline gas. Hitherto coronene was only obtainable by complicated processes, chiefly the hydrogenation of coal into liquid fuels, and it had not before been detected in American coals.

The United Nations Special Fund will contribute \$990,300 and the Chilean Government \$740,000 towards a \$1,700,000 mineral survey of the northern province of Chile. Mr. Paul Hoffman, managing director of the Special Fund described the project as a means of diversifying the economy of Chile, attracting capital for development of the mining industry in that area, and revitalizing a seriously depressed area.

The Dominican Republic firm of Sal y Yeso, which has invested \$5,000,000 in the development of the salt and gypsum deposits at Barahona, hopes to export 600,000 tons of gypsum annually, compared with the present 100,000 tons. An increase in the export of refined salt, at present 60,000 tons is also expected. It is stated that present deposits of gypsum and salt would last for a thousand years if 1,000,000 tons of each were exported annually. At present all salt is sent to the U.S.

According to the Polish paper *Odra*, work has begun on the preparation for exploitation of brown coal deposits near Musakow, on the river Neisse. The reserves are said to contain some 27,000,000,000 tonnes of coal.

Equipment costing about £800,000 is to be installed at a factory belonging to the Companhia Portuguesa de Fornos Electricos for the production of silicon alloys and ferro alloys of silicon, manganese, chromium and other metals.

Sand-washing dredgers capable of washing 50,000 cu. m. of sand per shift are now being used on the Unda and Chorny Urkum rivers in the Siberian diamond district. Only nine mechanics are said to be needed to man each unit.

Mr. Rutger Wijkner, at a recent meeting of the Swedish Ironmasters Association claimed workable deposits of iron ore in the Central Swedish mining districts to be at least 650,000,000 tonnes, which is considerably higher than the assessment of 400,000,000 tonnes made in 1950. The ore finds correspond to a volume of 255,000,000 tonnes of iron compared with an earlier assessment of 150,000,000.

Barclays Bank D.C.O., in a report from Israel, state that the Timna Copper Works exported its entire output of 5,400 tons of copper cement in the fiscal year 1959/60, and that indications of mineral primary copper recently discovered near Timna and a new appraisal of the known ore deposits there have led experts to double their estimates of the field's production potential. Earlier proven deposits were estimated at around 17-18,000,000 tons of ore averaging 1.4 per cent copper.

Russia's Mikhailovsky mine, the fourth in the area of the Kursk magnetic anomaly, was put into service on June 20 last. This opencast mine has a capacity of 4,500,000 tons of rich iron ore annually. Reserves totalling over 500,000,000 tons of ore containing slightly less than two-thirds of iron and not needing preliminary beneficiation have been disclosed in this area. The resources of ferrous quartzite are estimated at about 10,000,000,000 tons, and are claimed to be practically inexhaustible.

Exploration for ilmenite is reported to be under way in Mexico. The Mexican subsidiary of Du Pont, Pigmentos y Productos Quimicos S.A., will shortly start production of titanium oxide. Initially, ilmenite imported from Canada will be used.

Some 60,000,000 rupees are to be spent on mechanization of the iron ore mines at Rajhara, in India, near the Philai ferrous metals plant. Mining equipment has been ordered from Russia, as well as the ore crushing and separating plant.

The Spanish Government has given permission for the purchase by Montecatini of 45 per cent of the share capital in the Spanish company, Minas del Dubra. According to reports, work on the exploitation of titanium reserves in the Spanish province of La Coruna will now be intensified. Montecatini had previously taken over 40 per cent of the share capital of the Spanish tin and lithium producer, Actividades Mineras S.A.

At their meeting in New York on June 27, the Standing Committee of the International Lead and Zinc Study Group expressed concern less rapid deterioration be created by "further restrictive action" of the major industrialized countries. The committee noted that voluntary action by the producers had been "beneficial". Arrangements were made for the next session of the Study Group to be held in Geneva in September, 1960.

At an international chemical congress held in Mexico City in June, the use of nuclear explosions in the extraction of Mexican sulphur was forecast. It was stated that this should be considerably cheaper than the conventional Frasch method. Mexico hopes to expand her sulphur production by 100,000 tonnes a year.

Over 2,000,000 tons of fluorite deposits, in a six-mile seam, are reported to have been discovered in hilly country near Dungarpur, India. An intensive geological survey and boring operations are being carried out in the area. India is at present spending Rs. 44 lakhs per annum on imports of fluorite.

Stolberger Zinc AG, of Aix-la-Chapelle, one of West Germany's major lead-zinc producers, has announced the following production figures for 1959 (1958 results in parentheses): lead concentrates 33,105 tonnes (41,583); zinc concentrates 55,854 tonnes (54,488); lead, 18,166 tonnes (24,365); zinc 25,090 tonnes (24,889); soft lead 46,595 tonnes (46,344); hard lead 5,319 tonnes (3,159); crude zinc 39,819 tonnes (38,157). Export share of lead production rose to 11.6 per cent and that of zinc output fell to 14.3 per cent. The company recorded a profit for last year of DM. 2,850,000 against a 1958 loss of DM. 970,000.

Mr. G. Archer has relinquished his positions as chairman of the Mond Nickel Co. Ltd. and its subsidiary company, Henry Wiggin and Co. Ltd., and has been appointed president of Mond and Wiggin. Mr. Ivon A. Bailey has been appointed chairman and chief officer of Mond and Wiggin. Dr. L. B. Pfeil has been appointed vice-chairman of Mond. Mr. J. O. Hitchcock has been appointed managing director of Mond and deputy chairman of Wiggin. Mr. H. W. G. Hignett has been appointed managing director of Wiggin.

Metals and Minerals**Growth Prospects for the Non-Ferrous Metals**

Of the making of forecasts there is no end, particularly so far as the outlook for metal producers is concerned. That the unforeseen is liable to play havoc with the most authoritative predictions in no way lessens the importance of informal studies of growth prospects as an essential guide to long-term planning.

Prospects for non-ferrous metals are analysed in two interesting studies by U.S. investment experts, which were summarized in recent issues of *The American Metal Market*. In a ten-year forecast Dominick and Dominick, investment bankers, conclude that tonnage consumption of iron and steel produced in the U.S. should increase by about 3 per cent annually for the next ten years, but that, paced by aluminium, other metals particularly those fitting specialty jobs, will grow even faster.

In an era when the trend is toward the lighter, stronger and faster, states this forecast, aluminium has proved an almost ideal metal for volume use. Consumption in the U.S. has been growing at the rate of 11 per cent annually, but the increase in other countries has been even faster. U.S. domestic annual growth of 8 per cent over the next ten years is regarded as conservative. Rapidly increasing demands are seen for the electrical and packaging industries, but the building industry is expected to remain aluminium's best customer.

Research undertaken for current defence programmes, particularly in connection with rockets and missiles, has widened the range of formulations for stainless steel, which promises to qualify for new civilian applications.

As technological breakthroughs are achieved in the winning of pure metals from refractory and reactive metals, some of these metals may find use of strategic importance in missiles, atomic energy and electronics, and increases over previous limited consumption could prove spectacular. However, the fact that the government remains the principal user is regarded as to some extent clouding the investment prospects so far as these particular metals are concerned. Titanium is considered to offer the best outlook for volume use.

The second forecast appears in *Perspective*, monthly publication of the investment management department of Calvin Bullock, which points out that over four decades the growth of the twelve non-ferrous metals studied has closely paralleled that of the steel industry, enabling them to maintain their share of the construction trade.

The rise and growth of the aluminium industry are described as an outstanding feature of the Fifties. This growth is seen as settling down at the steady and impressive rate of about 16 per cent a year. Markets are expected to broaden and some inroads on steel are indicated. However, it is pointed out that the potential for increasing the strength and performance of carbon steel indicate recuperative powers for its producers. An important non-ferrous by-product of the

competitive conditions foreseen could be accelerated development of the additive metals, such as nickel, chromium and molybdenum, as the steel industry seeks to increase the strength and performance of its products through further exploitation of aluminium.

Commenting on individual metals, the report considers that copper's longer term performance suggests a vitality which may have been underestimated. There is a noticeable degree of confidence that both the electrical equipment and building industries will provide necessary outlets to support further expansion of copper production. Lead's prospects are not regarded as encouraging, but in the case of zinc it is stated that the development of a new galvanizing process for flat rolled steel products promises renewed favour in this traditional market.

The view is expressed that, with ample supplies now available again, it would not be surprising to see the nickel and chrome trades enter a period of more rapidly rising dollar volume. Among the steel alloying elements, molybdenum's prospects are regarded as particularly bright. Accelerated development in tungsten base alloys is foreseen. Doubt is expressed whether titanium will soon regain its former peak levels.

FLURRY IN PLATINUM FUTURES

Platinum futures trading on the New York Mercantile Exchange on Monday, June 27, was greater than for the entire first five months of the year. In the largest daily volume since trading began in December, 1956, a total of 142 lots was sold. This compares with total trading in the period from January 1 to May 31 of only 137 lots. Prices declined \$1.50 a troy ounce with trade selling offsetting commission house buying. There was heavy switching.

Refiners tended to deprecate the importance of the day's transactions in the futures market pointing out that there had been no change in the actual market and emphasising that despite the adequate supply, situation the metal was not in plentiful supply and imports from Europe had not been substantial.

After this flurry of speculative activity, conditions in the futures market reverted to normal.

TALKS ON NICARO

The General Services Administration has announced that conferences are being held in Washington with a Cuban mission on the Nicaro nickel plant. An announcement by the Agency said that a Cuban commission headed by Dr. Pedro Miret, Minister of Agriculture, had arrived in Washington for the purpose of entering into discussions with representatives of the U.S. Government regarding problems affecting the Nicaro plant. A U.S. vessel loaded with nickel

from Nicaro is still in a Cuban port because of a disagreement between the Cuban and U.S. Governments regarding Cuba's share of income from the plant. G.S.A. is trying to sell the plant and last December announced that it had received three offers from private industry which would be used as a basis for negotiations. At that time the Cuban Government expressed an interest in acquiring the plant.

A GAIN TO PLASTICS

It is claimed by Du Pont de Nemours that plastics will replace zinc on the instrument cluster panels of the Chrysler Corporation's 1961 model Valiant compact cars. According to Du Pont de Nemours, the new panel would weigh about 2 lb., whereas the present zinc panels weigh about 9 lb. There is now speculation as to whether other motor car manufacturers will follow the Valiant switch, either in the 1961 models or by 1962. Last year the zinc industry in the U.S. sold a total of about 175,000 tons of zinc castings to the motor car industry.

This new development is a significant pointer to the growing challenge to metal which must be expected from the plastics industry.

The Austrian magnesite industry has now recovered from the recession it experienced in 1958 and in the first half of last year. In the first quarter of the current year, output of crude magnesite in Austria at 383,600 tonnes was 44 per cent higher than in the same period of last year. Production of sinter magnesite at 117,900 tonnes was 32.5 per cent higher and that of caustically-burnt magnesite rose by 27.5 per cent to 29,000 tonnes. A new plant, operated by the Austrian-American owned Magnesit A.G., was opened in Hochfilzen in the first quarter of 1960, but is not yet working to full capacity. Ninety per cent of the output of the three main producers is now exported, the principal customers being the Common Market bloc.

COPPER FROM KENNECOTT'S EASTERN REFINERY

This week over 1,500 tons of "K.E." brand 265-lb. horizontally cast electrolytic wirebars, for delivery by Kennecott to Richard Johnson and Nephew Ltd., will arrive at Manchester. This is the first copper to reach the U.K. from Kennecott's new refinery at Hawkins Point, Baltimore, Maryland, U.S. The refinery, completed only last year, is now producing about 11,000 tons of copper per month and production will be increased to 16,500 tons later this year. Ultimately, further development stages will make this one of the largest refineries in the world. "K.E." brand copper is produced under rigid quality control and comes well within the A.S.T.M. Specification B.543.

U.S. MICA INDUSTRY

According to reports received from domestic fabricators of mica by the Bureau of Mines, U.S. Department of the Interior, 1,514,000 lb. of block and film mica were fabricated in the second half of 1959. This was 12 per cent more than in the first half of 1959, but only 3 per cent more than in the last half of 1958. However, fabrication in the second half of 1959 was higher than in any 6-month period since the second half of 1957.

Consumption of phlogopite block mica was 35 per cent lower than in the first half of 1959 and 4 per cent lower than in the last half of 1958. Electronic uses consumed only 8 per cent of the total phlogopite block fabricated, compared with 18 per cent in the last half of 1958.

U.S. BAUXITE STATISTICS

In the first quarter of 1960 domestic bauxite production in the U.S. was 481,000 l dry tons, reports the Bureau of Mines, U.S. Department of the Interior. This compared with 471,000,000 tons in the previous quarter. The increase in relation to the first quarter of 1959 was 33 per cent.

Bauxite imports of about 2,000,000 tons during the first quarter of 1960 represented a decrease of 5 per cent when compared to the figure for the last quarter of 1959. Imports from Jamaica declined 10 per cent from the previous quarter and supplied 50 per cent of the total imports. Surinam imports increased by 3 per cent and accounted for 38 per cent of the imports. The remaining 248,000 tons came from British Guiana, Haiti and the Dominican Republic.

*

It is reported from Cabo Rojo, Alcoa's bauxite terminal and port in the Dominican Republic, that in the 17 months since shipments were commenced in the specially built ore carriers, 740,000 tons have been sent to their U.S. plants. At the present rate of working, it is expected that 1,000,000 tons will have been exported by the end of 1960.

BRITISH GUIANA MANGANESE

Aluminium Ltd. has announced that Chaguaramas Terminals Ltd., its bauxite trans-shipment station in Trinidad, has completed long-term arrangements with Union Carbide for the handling of manganese ore shipped from British Guiana to North America via Trinidad. Beginning in July, it is expected that well over 100,000 tons of manganese ore will move through Chaguaramas annually from British Guiana. Chaguaramas Terminals is a fully-owned subsidiary of Aluminium Ltd., which has participated in the economic development of the Caribbean area for many years.

GALLIUM IN WIDER USE

Gallium is reported to be gaining more attention in the U.S. through its compound, gallium arsenide, a semi-conductor material which is being used in solar cells, rectifiers, high temperature devices, and other electronic units. Gallium phosphide and gallium antimonide

are finding applications in electronics and thermoelectrical cooling. More gallium metal was produced and shipped last year than in 1958, but production figures are not disclosed. The three U.S. producers are Alcoa, Anaconda and Eagle-Picher. The metal now sells for about \$3 per gram.

GOLD FOR SEMI-CONDUCTORS

Among the growing number of metals finding outlets in the semi-conductor field is gold, which is claimed to be an excellent matrix element for semi-conductor preforms. The material is

electro-neutral, wets readily to silicon and germanium, exhibits excellent oxidation resistance, and its high thermal conductivity permits rapid heat dissipation from the junction. Gold alloy pre-forms are now being supplied to the semi-conductor industry by a New York firm, Accurate Specialties Co., the gold being alloyed with such elements as tin, germanium or silicon, which reduce the melting point of the preform into the 275-400 deg. C. range. The company also supplies gold alloys, doped with Group III or Group V elements such as antimony, indium or gallium, for alloy junction processes in the manufacture of diodes, rectifiers and transistors.

COPPER · TIN · LEAD · ZINC

(From Our London Metal Exchange Correspondent)

The commencement of the holiday season has resulted in an appreciable loss of interest in the exchange, and turn-overs have suffered except in the case of tin. As would be expected under these circumstances, prices of copper, lead and zinc have tended to ease, whilst that of tin has been firm.

COPPER STILL HESITANT

The copper market has been quieter than for some time and prices have shown no significant movement. Events in the Congo continue to have an effect on the market and it is felt that as the situation there is by no means stable, the period of uncertainty in the copper market will last for some weeks. The only definite news from the Congo is that the present government does not intend to nationalize the mining industry. The Union Minière de Haut Katanga has announced that it is transferring its registration from the Congo to Brussels but that it intends to establish subsidiaries in the new Republic as soon as practicable. The backwardation in London has tended to narrow slightly with bear covering being less in evidence than during recent weeks: stocks in official warehouses rose by 82 tons to 3,440 tons.

TIN'S CONTINUED STRENGTH

The tin market has continued to show strength both in London and Singapore and although the former has been attributed to a technical position arising from the necessity for those firms who borrowed tin from the buffer pool manager to return same to him, the strength in the latter can only be attributed to a good demand from consuming countries. The backwardation has remained fairly constant and stocks of tin rose 44 tons to 8,748 tons. No further details have become available of the proposed new International Tin Agreement but a résumé of what is already known appears elsewhere in this issue.

On Thursday the Eastern price was equivalent to £804½ per ton c.i.f. Europe.

OUTLOOK FOR LEAD AND ZINC

In spite of reports of excellent consumption in the U.K., the undertone of the lead market remains uncertain in view of the probability that the restriction in availability will cease following the next meeting of the Study Group in Geneva in early September. In the U.S., trade is affected by the holiday season, whilst in Canada the reduction in the premium of the Canadian dollar has given the opportunity for a reduction of ½ c. per lb. in the lead price. Although the zinc prices have receded a little, it is not expected that the general level will become very much lower as there appear to be plenty of buyers on any small recession in price.

It is interesting to notice from the figures issued by the U.S. Bureau of Customs for the imports of lead and zinc for the second quarter of 1960, that whereas the lead ore, lead metal and zinc ore quotas have been filled, those for zinc metal have only been half filled by the Congo, Belgium and Italy and even for the near countries of Mexico and Peru, the final tonnage has fallen slightly short of the permitted total. A reasonable deduction from this is that consumption outside the American continent remains equal to production and that with the increased demand which can be expected during the second half of the year there is every reason to suppose that the price may go back to the higher level it reached earlier this year.

Closing prices are as follows:

	June 30		July 7	
	Buyers	Sellers	Buyers	Sellers
COPPER				
Cash	£256½	£257	£255	£255½
Three months ..	£245½	£246	£244½	£244½
Settlement ..		£257		£255½
Week's turnover		9,675 tons		6,800 tons
LEAD				
Current ½ month	£71½	£71½	£71½	£71½
Three months ..	£72½	£72½	£72½	£72½
Week's turnover		9,425 tons		5,450 tons
Tin				
Cash	£806	£807	£809½	£810
Three months ..	£795½	£796	£801	£801½
Settlement ..		£807		£810
Week's turnover		690 tons		1,055 tons
Zinc				
Current ½ month	£90½	£90½	£90½	£90½
Three months ..	£89½	£90	£89½	£89½
Week's turnover		4,550 tons		3,150 tons

London Metal and Ore Prices appear on inside back cover.

Mining Finance

Record Sales of Gem Diamonds

De Beers' Central Selling Organization which handles nearly 90 per cent of the world's sales of rough diamonds, including now those exported from Russia, is doing an increasing business in gem stones. This had been made clear enough by Mr. Harry Oppenheimer at last month's meeting of De Beers. It is underlined by the June quarter sales figures now published. They show that the turnover in gems reached a record £17,213,163 in the quarter, over £3,000,000 higher than in the preceding three months, compared with the previous peak of £16,891,253 in the September period of last year. The latest total for gems is not believed to reflect any increase in prices by the C.S.O. as has been suggested in some quarters. But it indicates that the demand for diamonds is still absorbing up to the hilt all the stones currently being mined in Africa and elsewhere.

On the basis of gems alone there would be a probability that the record figure in 1959 of £91,100,000 for all classes of stones would be surpassed this year. But there is a different picture in industrial material. Here the falling away in American stockpiling for strategic needs and the competition from the manufacture of synthetics in the U.S. in causing some reduction in the turnover in natural stones. Thus, last quarter's figure of £6,119,400 is the lowest since the final quarter of 1958. It means that the aggregate sales of all stones in the first six months of the current year are at £43,700,000, actually just on £1,500,000

lower than the £45,200,000 for the same period of 1959.

The principal source of industrial stones is the Belgian Congo, now the African-governed Congo state. The Congo is, in fact, easily the largest producer of diamonds in the world by weight, but it is well surpassed by Southern Africa so far as value is concerned because its output is predominantly of small stones and boart used for industrial purposes. It remains to be seen how the Société Minière du Bécéka, the chief Congo producer, gets on under the new régime. Extracts from their directors' report appear on p. 52. One thing seems fairly certain. The unsettled political state of this major source of industrial diamonds is likely to redouble America's efforts to become self-sufficient in this class of material either through its stockpile or through increasing the production of synthetic stones.

De Beers' Deferred improved to 146s. 3d. following publication of the latest sales figures, still a far cry from the £10 touched earlier this year before South Africa's racial troubles hit the share market so hard. The yield on the increased payment for 1959 of 12s. 6d., which looks certain to be repeated this year, is 8.5 per cent before allowing for double tax relief. This is attractive for anyone with faith in the future of Southern Africa. Certainly there seems to be no question of South Africa's diamonds being affected by the various boycotts that are being attempted.

LONDON MARKET HIGHLIGHTS

Influenced largely by further unpalatable political news from Africa, South African Gold shares have continued to drift. The period began with a rally in full swing but this, like its predecessors, proved abortive. On several occasions since leading Kaffirs have tried to take off, only to be brought back to earth first by Dr. Verwoerd's weekend "no compromise" speech, and later by the succession of reports of troubles in the newly-independent Congo.

Losses on the week, however, were not substantial. Free State Geduld, for instance, started the week with a rise from 121s. 3d. to 123s. 1½d., and eventually closed at 116s. 3d. Ofits (71s. 10½d.) lost 2s. 4½d. on balance, and overall declines of the same order were seen throughout the Kaffir market including such shares as President Brand (59s. 6d.), Western Holdings (115s.), West Driefontein (81s. 3d.) and St. Helena (63s. 9d.). Free State Saaiplaas (11s.) was also affected by rumours that new capital would soon be needed.

Finance houses were subject to the same influences and a similar pattern was apparent. Gold Fields came back from 63s. to 59s. 9d., Union Corporation (50s.) lost 2s. 3d. on balance, and Anglo American finished at 147s. 6d., a decline of 3s. 3½d. on the week.

Coppers looked quite firm during the early part of the period and some useful rises were seen. On one day Nchanga put on 4s. 10½d. to the accompaniment of optimistic talk regarding the final dividend now due. Other shares moved less sharply but the undertone was firm. Then came the news of mutiny and rioting in the Congo

and a general retreat was signalled. Nevertheless, most leading Rhodesians completed the week with small plusses. Nchanga closed at 60s., Rhokana at 50s., and Bancroft at 19s., all marginally above the levels of this time last week.

Tanganyika Concessions (34s.), with its big stake in Union Minière, was naturally severely hit by the Congo news but even so lost only 2s. 3d. overall. Kentan (27s. 6d.) moved similarly.

Once again it was Tin shares that brought a semblance of well-being to mining markets. At first, eastern shares—and particularly eastern favourites like Ayer Hitam—led the way. By mid-period, however, profit-takers had begun to reappear, and with Far Eastern demand slackening shares like Tronoh (42s. 6d.), Sungei Besi (31s. 9d.) and Ayer Hitam (122s. 6d.) all closed at levels little different from those at which they stood last week.

However, Nigerians took up the running in mid-week, led by Gold and Base (2s. 6d.) which looked very firm after the publication of its optimistic report. Amalgamated Tin finished at 11s., fractionally higher on balance.

Elsewhere De Beers was tugged in opposite directions by South African politics and Wednesday's announcement of record gem sales, and the shares moved erratically to close at 145s. 7½d. Mt. Isa was a quiet market until the record output figures were announced. Then the shares came to life and rose to 51s. Consolidated Zinc followed the zig-zag course of Industrial markets and ended the week at 78s., a gain of 1s. 3d.

AYER HITAM'S DREDGE SHUT-DOWN

Ayer Hitam Tin Dredging has issued some further details of the capitalization issue first announced here on June 24. As then stated, it will take the form of an allocation to holders of four fully paid 5s. shares for every one held on July 14 and it will raise the issued capital from £305,000 to £1,525,000. An extraordinary meeting has been called for July 26 to consider a resolution increasing the authorized capital from £325,000 to £1,750,000.

The pending issue is to be met by the capitalization of the share premium account of £421,989 and £798,011 being part of the general reserve. In justification for the issue it is pointed out that about £1,000,000 has been invested in the purchase and installation of the second dredge which is expected to make "substantial" profits on the basis of its present output quota under the International Tin Agreement.

It will not, however, be until the latter part of 1961 that Ayer Hitam will reach its full profit potentialities. This is because the shut-down of the No. 1 dredge for modernization is expected to last for about nine to twelve months from the beginning of next October.

Meanwhile, it is believed that the company's third interim dividend for the year to June 30 will be declared before July 14 on the present capital. The first interim was 4½d. a share, the second was 9d. The market hopes for a fresh increase in the third payment. Subsequently there should be a fourth interim and a final for which the new shares will rank. Present price of Ayer Hitam is 127s. 6d.

WINKELHAAK'S PROFIT UP SHARPLY

The June monthly output figures for the South African gold and uranium mines had not the slightest influence on the share market. It is nevertheless worth noting that new profit records were set up by Western Holdings (£850,451) in the Anglo American group, Harmony (£539,938) and Blyvooruitzicht (£812,344) in the Central Mining group, Buffelsfontein (£536,244) in the General Mining group, West Driefontein (£1,122,546) in the Gold Fields group and Winkelhaak (£145,258) in the Union Corporation group.

Probably the most impressive of these was the further sharp rise in the earnings of Winkelhaak, the newly-fledged producer in the new Kinross field of the Far Eastern Rand. The monthly profit has now risen steadily from £53,276 last November. The latest surplus comes from a crushing of 90,000 tons, which is the present nominal capacity of the plant, and a gold recovery of 6.4 dwts. a ton compared with an ore reserve average of 6.8 dwts.

There is now likely to be a pause in the expansion of Winkelhaak's profits pending the culmination of plans further to extend the plant to 150,000 tons a month and to sink another shaft. This is to be financed out of profits, but it has been officially indicated that it should be possible to do this and still make an early dividend debut. It is hoped, in fact, that a maiden payment will be announced next December.

LONG HAUL FOR "RHO-KATS"

The Rhodesia-Katanga report for 1959 was evidently read optimistically by the market probably because the new chairman, Mr. M. T. W. Easby, seemed to indicate his faith that the flooded Kansanshi copper mine in Northern Rhodesia, in which the

company has a 35 per cent interest, will be dewatered and brought to production one of these days. And if it is Rhodesia-Katanga, he said, would be able to rely on the associated Tanganyika Concessions company to assist in the provision of the necessary finance.

This is undoubtedly comforting to shareholders, but anyone who is tempted to rush in the £1 shares—now 12s.—would be wise to dwell upon the fact that any decision to proceed with Kansanshi is unlikely indeed in the present unsettled political situation of this particular part of Africa. This is quite apart from the fact that the metallurgical problems involved in treating the mine's ores have still to be finally overcome.

Rhodesia-Katanga's balance sheet is also in rather a sorry state. The auditors point out that in their opinion the investment in Kansanshi and the value of the coal and mineral rights standing respectively at £942,653 and £369,383 are under present conditions worth less than this. Quoted investments appearing at £276,671 also had a market value of only £120,027 at the end of 1959. Rhodesia-Katanga thus has a very long haul ahead of it even if Kansanshi does eventually turn up trumps.

COLUMBITES AT £1,000 A TON

A fluttering in the columbite dovescots has been caused by the statement in the Gold and Base Metal Mines of Nigeria annual report that the company's ore sales in 1959 were based on a columbite metal price of £1,003 a ton. This is a very good price by any standards and it has stimulated the hopes already held that the producers of this metal should show sharply expanded earnings in the current year. They include Amalgamated Tin Mines of Nigeria, Bisichi and Jantar.

Gold and Base itself has been able to return to the dividend list with a payment of 7½ per cent on the 2s. 6d. stock units for 1959. This absorbs £35,372 out of a profit of £57,021. For 1958 the profit was only £5,526 and on that occasion no provision was made for depreciation against an allocation of £19,346 now.

For 1960 there is a production target of 780 tons of tin ore against last year's permitted sales of 454 tons, but the target for columbite is only 75 tons against last year's sale of 98 tons. The disposal of 70 tons of columbite in 1960 has already been negotiated. The chairman, Mr. C. J. Burns, is a little cautious about costs. He reckons that the attainment of independence by Nigeria next October will bring some increase in expenses to the mining industry there, although higher output should offset the effect of this to quite a large extent.

Gold and Base are currently quoted at par (2s. 6d.) and it will be disappointing indeed if the dividend is not increased this year beyond the 7½ per cent paid for 1959.

OBITUARY

Mr. A. V. Conrad

We regret to announce the death of Mr. A. V. Conrad, an executive director of Union Corporation. He was forty-eight.

Mr. Conrad joined Union Corporation in 1932, and during the war served in the Ministry of Economic Warfare. He was appointed a manager of Union Corporation in 1948 and became a director in 1957.

Mr. Conrad was chairman of San Francisco Mines of Mexico and a director of Selection Trust, Bay Hall Trust and British Enka. He was a member of the Council and of the Executive Committee of the British Overseas Mining Association, of which he was president in 1958-1959.

SOCIÉTÉ MINIÈRE DU BÉCÉKA

The Fortieth Annual General Meeting of the Société Minière du Bécéka was held on May 25, 1960. The following are translated extracts from the Directors' Report:—

We look forward with confidence to the coming of political independence to the Congo. Our company is conscious of having contributed to the economic development of the country by devoting finance and technical know-how to the development of her natural resources, which has brought prosperity to the vast region where our company operates. We will continue our efforts to help the new Republic to realize its objectives in the field of economic expansion and of social advancement.

Diamond Market

The sudden contraction in the market for industrial diamonds in 1958 and the introduction of a synthetic product led us to curtail our production programme in 1959. Output totalled 14,196,261 carats, against 16,004,150 carats in 1958. In fact this total exceeded planned production in consequence of the commissioning, partially in June 1959 and completely in December, of the central concentration and recovery plant. This plant, which is fully automatic, promises an almost complete recovery of diamonds. It is intended gradually to replace the washeries now dispersed on the deposits between the Kanshi and Bushimaie rivers. This should significantly reduce working costs.

The notable progress in the stripping of overburden has been maintained. The total quantity of overburden and gravel excavated was 4,015,120 cubic metres, against 5,642,000 cubic metres in 1958. Mechanization is now practically complete, and 99.8 per cent of the total was extracted mechanically against 98.4 per cent in 1958.

Studies for a new central sorting station have been continued. New techniques are to be employed, including the electronic detection and separation of diamonds to facilitate the final stages of treatment and supersede all manual intervention.

In 1959, capital expenditure amounted to francs 268,000,000 bringing the total spent from the foundation of our company up to the end of 1959 to francs 3,381,000,000 out of which francs 2,488,000,000 have been invested during the period 1953-59.

Prospecting

In the Lubilash area, reserves declined during the year without, however, prejudicing production prospects. An alluvial deposit has been discovered in the Bushimaie basin. Other interesting discoveries have been made in the Katsha basin although the Kimberlite occurrences at the sources of this river have proved to be without economic interest.

On the right bank of the Luebo, new discoveries have kept pace with production. An aeromagnetic survey undertaken there at the beginning of 1959 showed strong magnetic anomalies in certain zones of high diamondiferous concentration. This seems to confirm

the existence of a primary source. Drilling and geochemical testing are seeking to localize it.

Power Situation

The plants at the Young and Tshala power stations have been able to meet all power requirements. A modification to the turbo-alternator sets at the Young station, however, is planned in order to meet an anticipated increase in consumption.

Personnel

In spite of the tribal fighting which has bedevilled the province of Kasai the situation in the towns has remained calm, and there has been no fighting between Baluba and Lulua workers. Morale has remained high. In this respect the company is enjoying the reward of its efforts over many years towards improving the conditions of its personnel.

In the Lubilash section, promotion of advanced Congolese is continuing. Eighteen of these are taking part in an accelerated training programme. Apart from technical training, they are receiving, together with their wives, a general course designed to facilitate their social integration. At the end of their studies they will undertake responsible duties carrying remuneration appropriate to their merit and their aptitude.

The introduction of the "training within industry" method is making an effective contribution both to profits and to the advancement of our employees. About 5,000 men at Bakwanga have been trained on the job by their European foremen, thus obviating any need to send them to technical school. The results obtained are remarkable bearing in mind the obstacles met in the early stages: general ignorance and chronic under-nourishment.

A further group of advanced Congolese toured Belgium for a period of fourteen days in 1959. This tour, like its predecessors, has proved fruitful; and for those taking part it has made possible a closer understanding of the realities of daily life in our country.

New recruitment has been suspended and the working force will be allowed to decline by natural wastage without any retrenchment. It is thought that the situation will become stabilized towards the middle of 1960.

General

A new social order is establishing itself in the Congo. To help this evolution take place harmoniously our company has been actively encouraging contacts between Europeans and Congolese, both at work and socially.

Subsidiary Companies

1959 production of Société Bécéka Manganese rose to 289,500 tonnes of saleable ore. All the 1960 production of ore is already sold. The capital of this company has been doubled by capitalisation of reserves and 400,000 new ordinary shares of no par value are now in issue.

THE STANDARD BANK OF SOUTH AFRICA LIMITED

SIR EDMUND HALL-PATCH ON NEED TO MAINTAIN AND INCREASE CAPITAL INFLOW TO TROPICAL AND SOUTHERN AFRICA

The Annual General Meeting of The Standard Bank of South Africa Limited will be held on July 27 at 10 Clements Lane, London.

In the course of his statement circulated with the report and accounts, Sir Edmund Hall-Patch, the Chairman, said:

After making the necessary provisions, the profit for the year is £1,180,968, an improvement of £100,104 on that of the previous year. It is now recommended that a final dividend of 1s. 9.6d. (9%), less tax, per share be paid, making a total distribution of 2s. 9.6d. (14%) per share.

Conditions in the Union of South Africa, the Federation of Rhodesia and Nyasaland and East Africa are then reviewed.

Importance of Capital Inflow

The Chairman said: Last year I referred to the difficulties facing various parts of Africa and the need to maintain and increase capital inflow. These difficulties have not diminished in the year under review, and pressures, both

external and internal, have been operating to discourage, rather than to maintain or increase, the amount of overseas investment.

External pressures upon Africa are seen in the desire in many Western Legislatures to pass on with all speed to less-developed areas the benefits of modern social and political society; in doing this, there is a temptation to ignore the importance of a sound economic sub-structure in the vain hope that real political and social advancement can be achieved without it.

Internal pressures have been of two kinds. First, there are the forces of emerging political independence; here again there is a tendency to ignore economic essentials, and at the same time to increase demands on local government and enterprise while there is lack of experience and a shortage of trained administrators, as well as of money. Secondly, there are political doctrines which tend to restrict an equitable spread throughout the entire population of the improvements in working, living and social conditions which are the normal corollaries of economic progress. Where these doctrines are harshly applied, those

discriminated against resent the treatment they receive. As a result, political stability comes under strain.

Since the end of the second World War, a continuing feature of the world economic scene has been the efforts by capital-exporting countries, nationally and internationally, and through private enterprise, to develop the less advanced areas. It is, however, an inescapable fact that those funds remaining available for investment by the industrialised world, after its own domestic needs have been met, are insufficient to satisfy all development needs. Therefore, such funds will inevitably tend to be directed to those developing countries where the investment climate is favourable—that is, where capital and technical assistance can best be applied. By this I mean where there is a stable Government, which is able to maintain law and order and establish its credit; and which has the determination and ability to develop and strengthen the economy while raising, in harmony, the material, social and political standards of every section of the population. To those countries, capital and skills will be made available in preference to others where these conditions do not exist. These facts, and the lessons to be drawn from them, have yet to be fully appreciated throughout tropical and Southern Africa. Once appreciated there can be few parts of the world where the prospects for economic, social and political advancement are more promising or more exciting.

STILFONTEIN GOLD MINING COMPANY LIMITED

(Incorporated in the Union of South Africa)

CHAIRMAN'S SPEECH

At the Annual General Meeting of Stilfontein Gold Mining Company Limited, held on June 7, 1960, Mr. C. W. Roper presided and addressed the Meeting as follows:—

I would like to add to the Chairman's Review which you have before you some supplementary remarks on the results at the mine over the past 5 months.

In the report for the March quarter of this year, shareholders were advised that the payable footage for the quarter was 4,530 feet, representing a percentage payability of 73.7% and averaging 381 inch dwts. for gold and 12.58 inch lbs. for uranium. During the past 2 months there has been a continued improvement. In April the payable footage was 1,390 feet, equivalent to a payability of 76%, averaging 423 inch dwts., for gold and 12.21 inch lbs. for uranium. During May the corresponding figures were 1,565 feet, a payable percentage of 83% and values of 484 inch dwts. and 9.26 inch lbs.

Last month shareholders were advised through the press of the reef intersection in the Toni Shaft. 10 sections sampled averaged 713 inch dwts. for gold and 29.05 inch lbs. for uranium. Subsequently during the cutting of 13 station a further exposure of 75 feet of reef was made, which on sampling averaged 565 inch dwts. and 36.66 inch lbs. respectively. In this connection it is interesting to recall that the original boreholes

S.T. 13 and H.B. 4 in this eastern section of the lease area failed to intersect reef due to faulting and these are the first reef intersections which we have had from this area. I think we are justified in inferring from the steady improvement in development and the results disclosed in the Toni Shaft, that the zone of low percentage payability encountered in the Margaret Shaft area in the first months of last year is limited in extent.

As against this improvement in the development outlook, I feel I should remind you that the problem of water in the upper levels is still with us and although the volume entering the mine remains static, the extra pumping and cementation costs, necessary to control it, are still considerable. You will have

learnt from the published figures that the profits and costs for the current year have also been adversely affected by the temporary interruption in hoisting at the Margaret Shaft which occurred during February and the power shortage in March.

It will be necessary in due course, when the shallower northern and north-eastern areas of the mine are approaching depletion, to extend mining operations below the 4,200 feet horizon, i.e. below 16 level. Access to the deeper area will be provided by means of the new Scott shaft, mentioned by Mr. Scott in his Review. Initially its principal functions will be to facilitate the development and ventilation of the deeper levels and in due course it will gradually take over the hoisting duties of the Charles and Toni Shafts as mining operations extend below the limiting depths of these two older shafts. Eventually all hoisting of ore will be done through the Scott and Margaret Shafts, while the James and Toni will eventually be used only for up-cast ventilation.

METAL STATISTICS, 1960

Now in its 53rd edition, *Metal Statistics, 1960* (pp. 832, published by American Metal Market at \$3.50 or \$3.75 by post), is a recognized standard reference for metal industry executives, purchasing agents, metal sales experts, market research and special survey staffs, economists, investment analysts, and writers on national and world affairs. The work is packed with more than 400 pages of statistics covering all of the

important metals from aluminium and beryllium to vanadium and zinc.

The volume also contains an index, a valuable 130 page Buyers' and Sellers' Guide and numerous advertisements of interest to members of the ferrous and non-ferrous metals trade. Among the new tables added this year, are four on plastics one of which is a comparison of the cost of plastics with other metals.

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Coming Events

The 21st International Geological Congress will be held in Copenhagen, August 15-25. Conducted geological excursions are being arranged for geologists both before and after the Congress to other Scandinavian countries.

★

The 2nd International Compressed Air and Hydraulics Exhibition, to take place from April 30-May 4, 1962, will be held at the Empire Hall, Olympia, London.

★

A list of the papers to be presented at the Mining Congress held by the Hungarian Mining and Metallurgical Society in Budapest, September 12-18, is now available from the Congress Office.

★

Twenty State Programme Committee chairmen for the 1960 Metal Mining and Industrial Minerals Convention and Exposition of the American Mining Congress are meeting in Las Vegas, Nevada, to draft the programme for the convention to be held at Las Vegas, October 10-13. The agenda is expected to include discussions on mine taxation, labour relations, the economic outlook for metals and minerals, latest developments in underground and open-pit mining, milling and metallurgical techniques, and advances in safety and processing operations. A very large exhibition of modern mining machinery, will be held in Las Vegas new Convention Centre.

★

The 67th annual general meeting of the Institution of Mining Engineers will be held on January 27, 1961, at the Royal Institution of Naval Architects, London. The Institution's summer meeting will take place in Nottingham, July 19-21, 1961.

★

The Ninth International Congress of Photogrammetry will be held at the University of London in September, 1960, under the auspices of the International Society for Photogrammetry. Technical sessions will take place from September 5-16, exhibitions from September 6-16, and technical tours from September 17-21. The address of the Congress is 18 Cavendish Square, London, W.1.

Air survey can be applied in two ways; first as the simple aerial photograph, and secondly as maps and plans made by measurements on the aerial photographs, or "photogrammetry". The first application is generally well known and understood. Much attention is now being paid to the second application, which is the science of measuring shapes in three dimensions through stereoscopic photography. A stereoscopic model, oriented and set to a correct scale (either by means of ground points of known position, located on the photograph, or by using entirely airborne aids such as radar altimeters and aircraft tilt measuring instruments) is a much more convenient subject to measure than the earth's surface at natural scale. Delays due to many obstacles disappear.

The Congress was briefly noted in our issue of June 10, 1960.

This feature appears every fourth week

THE SEVENTH COMMONWEALTH CONGRESS

The Seventh Commonwealth Congress, held under the aegis of the Commonwealth Council of Mining and Metallurgical Institutions, is being convened by the South African Institute of Mining and Metallurgy in collaboration with the Northern Rhodesian branch and Southern Rhodesian associates of the Institution of Mining and Metallurgy, London.

It will cover a period of six weeks of which the first four weeks, from April 10 to May 6, 1961, will be in the Union of South Africa; one week, from May 7-14, in Northern Rhodesia; and the final week, May 15-21, in Southern Rhodesia.

The second information brochure, now available, outlines the Congress programme and constitutes a summarized guide for prospective delegates.

The following is a list of authors and titles of the papers to be presented at technical sessions.

UNION OF SOUTH AFRICA

Tuesday, April 11, 1961, in Johannesburg: Introductory Papers: *The Organisation and Management of the Gold Mining Industry in South Africa*. President-elect, Transvaal and Orange Free State Chamber of Mines. *The Economy of the Union of South Africa*—W. J. BUSSCHAU, M. Com.(S.A.), C.A.(S.A.), D.Phil.(Oxon.), Chairman, Gold Fields of South Africa, Limited. *An Outline of South African Geography*—S. P. JACKSON, M.A.(Rand), D.I.C., Ph.D.(Lond.), Professor of Geography, University of the Witwatersrand. *Outline of the Geology of Southern Africa*—T. W. GEVERS, M.A., Ph.D., D.Sc., F.G.S., Professor of Geology, University of the Witwatersrand.

Wednesday, April 12, 1961, in Johannesburg: Informative papers: *The Coal Mining Industry of South Africa*—P. N. LATEGAN, D.Sc., F.Inst.F., Chairman, Transvaal Coal Owners Association. *The Iron and Steel Industry of South Africa*—F. MEYER, B.A., M.Sc., Dr.Eng., Chairman, South African Iron and Steel Industrial Corporation, Limited. *The Diamond Industry*—H. F. OPPENHEIMER, M.A.(Oxon.), Chairman, De Beers Consolidated Mines, Limited. *The Role of Government in Mining in South Africa*—Government Mining Engineer, Union Department of Mines. *Transport in South Africa with Special Reference to the Mining and Metallurgical Industries*—General Manager, South African Railways, Harbours, Airways and Motor Transport Administration.

Technical papers:

A—Mining and Geology: *Exploration of the Witwatersrand System and its Extensions*—R. BORCHERS, D.Sc., Member of the Geological Society of South Africa, Consulting Geologist, Rand Mines, Limited. *Stoping Practice on the Transvaal and Orange Free State Gold Fields*—R. A. MUDU, B.Sc.(Eng.)(Rand), M.S.A.Inst.-M.M., Assistant Consulting Engineer (East Rand), Anglo American Corporation of South Africa, Limited, with A. I. BECK, M.S.A.Inst.-M.M., Assistant Consulting Engineer (Orange Free State), Anglo American Corporation of South Africa, Limited, G. H. HENDERSON, M.B.E., M.C., M.S.A.Inst.-M.M., Assistant Consulting Engineer (Western Transvaal), Anglo American Corporation of South Africa, Limited and R. N. LAMBERT, M.I.M.M., M.S.A.Inst.-M.M., Assistant Manager, Western Deep Levels, Limited. *Underground Transport in the South African Gold Mining Industry*—A. LOUW, B.Sc.(Eng.)(Rand), M.S.A.Inst.-

M.M., Assistant Manager, West Driefontein Gold Mining Company, Limited and D. F. ODENDAAL, B.Sc.(Eng.)(Rand), A.M.I.Cert.M.E.E., Graduate(S.A.) I.E.E., Assistant Mechanical Engineer, Gold Fields of South Africa, Limited. *Ventilation and Air Conditioning Practice in South African Gold Mines*—M. BARCZA, Dipl.Mech.Eng.(Budapest), M.S.A.Inst.-M.M., A.M.I.M.M., Group Ventilation Engineer, Rand Mines, Limited and J. DE V. LAMPRECHTS, D.Sc.(Eng.)(Rand), M.S.A.Inst.-M.M., A.M.I.M.M., Group Ventilation Engineer, Anglo American Corporation of South Africa, Limited. *Iron Ore Mining*—B. C. ALBERTS, B.Sc.(Eng.), Chief Mining Engineer, South African Iron and Steel Industrial Corporation, Limited and J. A. L. ORTLEPP, M.Sc.(Eng.), Raw Materials Engineer, South African Iron and Steel Industrial Corporation, Limited.

B—Metallurgy: *Separation of Waste Rock*—A. T. MOIR, B.Sc.(S.A.), M.I.M.M., M.S.A.Inst.-M.M., Consulting Metallurgist, Gold Fields of South Africa, Limited and D. L. CARSON, B.E.(Min. & Met.)(Aust.), A.M.I.M.M., M.Aust.I.M.M., M.S.A.Inst.-M.M., Consulting Metallurgist, General Mining and Finance Corporation, Limited. *A Review of Modern Milling Practice at the South African Gold and Uranium Mines*—O. A. E. JACKSON, B.A.Sc. (British Columbia), D.I.C., Ph.D.(Lond.), M.S.A.Inst.-M.M., Consulting Metallurgist, Union Corporation, Limited. *A Review of South African Gold Recovery Practices*—J. K. E. DOUGLAS, M.Sc.(Eng.), M.I.M.M., M.S.A.Inst.-M.M., M.I.Q., Consulting Metallurgist, Rand Mines, Limited, and A. T. MOIR, B.Sc.(S.A.), M.I.M.M., M.S.A.Inst.-M.M., Consulting Metallurgist, Gold Fields of South Africa, Limited. *Laboratory Control: Gold Assaying and Uranium Analysis*—H. BRITTON, B.Sc.(Eng.)(Rand), M.I.M.M., M.S.A.Inst.-M.M., Consulting Metallurgist, Anglo-Transvaal Consolidated Investment Company, Limited. *Uranium in South Africa*—E. T. PINKNEY, M.S.A.Inst.-M.M., M.S.A.Chem.I., Consulting Chemical Engineer, Anglo American Corporation of South Africa, Limited and R. J. WESTWOOD, B.Sc.(Eng.)(Lond.), M.Eng.(McGill), A.R.S.M., A.R.I.C., M.I.M.M., M.S.A.Inst.-M.M., Consulting Metallurgist, Johannesburg Consolidated Investment Company, Limited. *Metallurgical Research in South Africa*—J. LEVIN, B.Sc.(Eng.)(Rand), M.S.A.Inst.-M.M., Acting Director, Government Metallurgical Laboratory.

C—Engineering: *Winding Plant of the Gold Mines of South Africa*—L. T. CAMPBELL PITT, O.B.E., M.I.Mech.E., M.S.A.I.-Mech.E., M.S.A.Inst.-M.M., Consulting Mechanical and Electrical Engineer, Gold Fields of South Africa, Limited. *Winding Rope Problems in South Africa*—A. R. MULLINS, B.A.(Eng.)(Oxon.), M.I.E.E., M.(S.A.) I.E.E., M.S.A.I.-Mech.E., Consulting Mechanical and Electrical Engineer, Union Corporation, Limited and I. S. HAGGIE, B.A.(Cantab.), Managing Director, Technical, African Wire Ropes, Limited. *Pumping Slimes*—W. J. ROSS, Consulting Mechanical Engineer, Johannesburg Consolidated Investment Company, Limited. *Water Problems of the Transvaal and Orange Free State Mines*—JOHN DOLAN, Hawksley Gold Metallist, Hon.M.S.A.I.-M.E., M.I.Mech.E., A.M.I.C.E., M.(S.A.) I.E.E., Consulting Electrical and Mechanical Engineer, Rand Mines, Limited. *Planned Maintenance and Workshop Control on the Gold Mines*—E. W. GRAY, B.Sc.(Eng.)(Rand), A.M.I.Mech.E., A.M.S.A.I.-Mech.E., Consulting Mechanical and

Electrical Engineer, General Mining and Finance Corporation, Limited. *The Use of Electric Power by the Gold Mining Industry*—M. R. GERICKE, B.Sc.(Elec.), M.(S.A.) I.E.E., Deputy Consulting Mechanical and Electrical Engineer, Union Corporation, Limited and B. J. CHEEK, A.M.(S.A.) I.E.E., A.M.I.E.E., Electrical Engineer, Union Corporation, Limited.

Friday, April 14, 1961, in Johannesburg:

Technical papers:

Group A—*Amphibole Asbestos in the Union of South Africa*—F. E. KEEP, D.Sc., M.I.M.M., Technical Consultant, Cape Asbestos South Africa (Pty) Limited. *The Messina Copper Mine*—W. I. SPENCE, M.A., B.Sc.(Min. & Met.)(Rand), Resident Manager, The Messina (Transvaal) Development Company, Limited and Officials of the Mine. *Geology, Mining Methods and Metallurgical Practice at Tsumeb*—A. P. G. SÖHNGE, M.Sc., Ph.D., Member of the Geological Society of South Africa, Chief Geologist, Tsumeb Corporation, Limited. *Tin Mining in South Africa*—E. K. McDERMOTT, A.R.S.M., B.Sc.(Eng.)(Lond.), M.I.M.M., Assistant Consulting Engineer, Gold Fields of South Africa, Limited and G. ST. J. OXLEY OXLAND, B.Sc.(Eng.)(Rand), M.I.M.M., Manager, Rooberg Minerals Development Company, Limited. *Antimony in the Murchison Range of the North-Eastern Transvaal*—E. W. SAHLI, Manager, Consolidated Murchison (Tvl.) Goldfields and Development Company, Limited.

Group B—*Manganese in the Union of South Africa*—L. G. BOARDMAN, D.Sc.(Pretoria), Member of the Geological Society of South Africa, Chief Geologist, African Metals Corporation, Limited. *The Electrolytic Recovery of Manganese from the Uranium Plant Barren Solution at West Rand Consolidated Mines, Limited*—R. W. SHEARER, Technical Assistant, Metallurgical Department, General Mining and Finance Corporation, Limited. *The Production of Ferro-Alloys*—N. SMIT, B.Sc., Technical Manager, African Metals Corporation, Limited and J. J. COETZEE, B.Sc., B.Sc.(Eng.), Development and Research Engineer, African Metals Corporation, Limited. *Iron and Steel Production in South Africa*—C. M. KRÜGER, D.Sc.(Eng.), General Manager and Director, South African Iron and Steel Industrial Corporation, Limited, with E. KLEIN, B.Sc.(Eng.), M.S., Manager, Technology, Development and Mining Department, South African Iron and Steel Industrial Corporation, Limited and C. P. WARDEN, B.Sc.(Eng.), M.S., Ph.D.(Chem.), Manager, Production (Works) Department, South African Iron and Steel Industrial Corporation, Limited. *Recovery of Ilmenite, Rutile and Zircon at Umgababa*—G. LANGTON, B.Sc.(Chem. Eng.)(Rand), M.S.A.Inst.-M.M., A.M.S.A.Chem.I., Assistant Consulting Chemical Engineer, Anglo American Corporation of South Africa, Limited and E. J. JACKSON, A.M.S.A.Chem.I., M.A.I.M.E., Manager, Umgababa Minerals, Limited. *Vanadium Recovery from Titaniferous Magnetites of the Bushveld Igneous Complex*—E. T. PINKNEY, M.S.A.Inst.-M.M., M.S.A.Chem.I., Consulting Chemical Engineer, Anglo American Corporation of South Africa, Limited, with N. E. PLINT, B.Sc., A.M.I.M.M., Manager, Minerals Engineering Company South Africa (Pty) Limited, D. D. HOWAT, B.Sc., Ph.D., F.R.I.C., F.I.M., Director, Central Metallurgical Laboratory, E. R. RUDOLPH, M.Sc., M.S.A.Inst.-M.M., Head of Mineral Dressing Section, Central Metallurgical Laboratory and G. S. JAMES,

O.B.E., M.Sc., M.S.A.Chem.I., Acting Head, Extraction Metallurgy Section, Central Metallurgical Laboratory.

Tuesday, April 18, 1961, in Welkom :
Technical papers :

Group A : *The Role of Geology on the Gold Mines of the Witwatersrand and the Orange Free State*—A. E. WATERS, B.A., Ph.D., Member of the Geological Society of South Africa, Consulting Geologist, Anglo American Corporation of South Africa, Limited. *Shaft Sinking in South Africa*—D. M. JAMIESON, M.C., B.Sc.(M.Eng.), M.S.A.Inst.M.M., Consulting Engineer, Gold Fields of South Africa, Limited, with M. P. PEARSE, M.C., A.M.S.A.Inst.M.M., Senior Technical Assistant, Gold Fields of South Africa, Limited and E. R. A. PLUMSTEAD, M.S.A.Inst.M.M., Assistant Engineer, Gold Fields of South Africa, Limited. *A Review of Tunnelling Techniques in the Gold Mining Industry*—S. C. NEWMAN, B.Sc.(Eng.)(Rand), M.A.(Oxon.), M.S.A.Inst.M.M., A.M.I.M.E., Development Engineer, Rand Mines, Limited. *The Development of an Extraction Plant for the Removal of Blasting Fumes*—S. R. RABSON, B.Sc.(Chem. Eng.), A.M.I.Chem.E., Head of Uranium Division, Transvaal and Orange Free State Chamber of Mines Research Laboratories. *Developments in the Valuation of Gold Mining Properties from Borehole Results*—D. G. KRIGE, M.Sc.(Eng.)(Rand), M.S.A.Inst.M.M., Financial Engineer, Anglo-Transvaal Consolidated Investment Company, Limited. *Recent Advances in Mine Sampling and Underground Valuation Practice in South African Gold Fields*—H. S. SICHEL, D.Sc.(Rand), F.S.S., M.S.A.Inst.M.M., Director, Operational Research Bureau and R. ST. J. ROWLAND, M.S.A.Inst.M.M., Group Surveyor, Rand Mines, Limited.

Group B : *Progress in the Design of Vertical Shaft Headgears on the South African Gold Fields, with Special Reference to Modern Types in Use*—A. C. BACKEBERG, B.Sc.(Eng.)(Rand), M.I.Mech.E., M.S.A.I.-Mech.E., M.(S.A.)I.E.E., Consulting Mechanical and Electrical Engineer, Anglo-Transvaal Consolidated Investment Company, Limited. *Design and Construction of Underground Bulkheads and Water Barriers*—W. S. GARRETT, M.B.E., B.Sc.(Eng.), A.M.I.C.E., A.M.S.A.I.C.E., Managing Director, The Cementation Company (Africa) (Pty) Limited and L. T. CAMPBELL PITT, O.B.E., M.I.Mech.E., M.S.A.I.-Mech.E., M.S.A.Inst.M.M., Consulting Mechanical and Electrical Engineer, Gold Fields of South Africa, Limited. *The Equipment of Vertical Shafts : Present South African Mining Practice and Development Trends*—D. M. BENTLY, B.Sc.(Eng.), M.I.Mech.E., M.I.E.E., M.S.A.I.Mech.E., M.(S.A.)I.E.E., Consulting Mechanical Engineer, Anglo American Corporation of South Africa, Limited. *Brackish Waters of the Mines of the Orange Free State Gold Fields : A Problem Underground and on Surface*—R. H. BRYSON, M.S.A.Inst.M.M., Manager, Free State Geduld Mines, Limited, with H. T. CLAUSEN, A.M.I.C.E., A.M.I.Mun.E., A.M.(S.A.)I.C.E., Group Civil Engineer, Anglo American Corporation of South Africa, Limited and W. H. MOYERS, B.Sc.(Eng.)(Rand), A.M.I.C.E., A.M.(S.A.)I.C.E., Assistant Group Civil Engineer, Anglo American Corporation of South Africa, Limited. *The Conversion of South African Low Grade Coal to Oil and Chemicals*—P. E. ROUSSEAU, M.Sc., M.I.-Chem.E., A.R.I.C., F.Inst.Pet., Managing Director, South African Coal, Oil and Gas Corporation, Limited. *The Benefits of the Contracts System in Drilling for Mining*—R. M. FERGUSON, General Manager, Sales Division, Boart & Hard Metal Products

South Africa, Limited, with D. MCKENZIE, Assistant Manager, Sales Division, Boart & Hard Metal Products South Africa, Limited, E. POPPLEWELL, A.R.S.M., B.Sc., Drill Superintendent, Boart & Hard Metal Products South Africa, Limited, D. MULLER, B.Sc., Civil Engineer, Boart & Hard Metal Products South Africa, Limited and H. GILBERT, Crown Sales Manager, Boart and Hard Metal Products South Africa, Limited.

Monday, April 24, 1961, in Kimberley :
Technical papers :

Diamonds : *Diamond Mining in Southern Africa*—G. S. GILES, B.Sc.(Eng.)(Rand), M.I.M.M., M.S.A.Inst.M.M., Consulting Engineer (Diamonds), Anglo American Corporation of South Africa, Limited. *Diamond Recovery in Southern Africa*—R. J. ADAMSON, B.Sc.(Pretoria), M.I.M.M., M.S.A.Inst.M.M., Consulting Metallurgist, Anglo American Corporation of South Africa, Limited. *Industrial Diamond Research*—R. G. WEAVING, M.Sc. (Eng.)(Rand), Joint Director, Diamond Research Laboratory and J. F. H. CUSTERS, Ph.D., Joint Director, Diamond Research Laboratory.

Friday, May 5, 1961, in Johannesburg :
Technical papers :

Group A : *Education and Training for Mining and Metallurgy in South Africa*—R. A. L. BLACK, D.S.C., A.R.S.M., B.Sc.(Lond.), M.I.M.M., Chamber of Mines Professor of Mining Engineering, University of the Witwatersrand. *European Labour on Mines, Members of the Transvaal and Orange Free State Chamber of Mines*—V. C. ROBINSON, B.Sc.(Eng.)(Rand), M.I.M.M., M.S.A.Inst.M.M., Labour Adviser, Transvaal and Orange Free State Chamber of Mines. *Accident Prevention on Gold Mines, Members of the Transvaal and Orange Free State Chamber of Mines*—E. G. STOKES, B.Com.(Rand), Assistant Secretary, Prevention of Accidents Committee, Transvaal and Orange Free State Chamber of Mines. *The Place of Mental Health in the Gold Mining Industry*—R. A. MATHEWS, M.B., Ch.B., M.R.C.S., L.R.C.P., Chief Medical Adviser, Transvaal and Orange Free State Chamber of Mines. *Pneumoconiosis : A Review*—A. J. ORENSTEIN, C.B., C.M.G., C.B.E., D.S.C., LL.D., M.D., F.R.C.P., Late Director, Pneumoconiosis Research Unit, Consultant, Rand Mines, Limited and I. WEBSTER, B.Sc.(Hons.), M.B., B.Ch., Head, Pathological Division, Pneumoconiosis Research Unit. *Dust Control and Research Underground*—P. H. KITTO, M.Sc., Director, Chamber of Mines Dust and Ventilation Research Laboratory. *Native Labour on the Gold Mines*—J. A. GEMMILL, M.A.(Oxon.), General Manager of the Native Recruiting Corporation, Limited and The Witwatersrand Native Labour Association, Limited. *Applied Physiological Research in the Gold Mining Industry*—C. H. WYNDHAM, M.B.(Rand), M.R.C.P.(Lond.), Member of Physiological Society (G.B.), Medical Research Society (G.B.), etc., Director of the Applied Physiology Laboratory of the Transvaal and Orange Free State Chamber of Mines.

Group B : *The Explosives and Chemical Industries in South Africa with Special Reference to Mining*—D. P. LIEBENBERG, M.Sc., A.M.I.Chem.E., M.S.A.Chem.I., Production Director, African Explosives and Chemical Industries, Limited. *Rock Mechanics Research in South Africa, with Special Reference to Rockbursts and Strata Movement in Deep Level Gold Mines*—F. G. HILL, B.Sc.(Eng.)(Rand), B.A.Jurisprudence(Oxon.), M.S.A.Inst.M.M., M.I.M.M., M.S.A.I.M.E., M.S.A.I.P.M.,

Technical Manager, Rand Mines, Limited and H. G. DENKHAUS, Dr. Ing., A.M.S.A.I.-M.E., Acting Director, National Mechanical Engineering Research Institute of the South African Council for Scientific and Industrial Research. *The Exploitation of the Platiniferous Ores of the Bushveld Igneous Complex with Particular Reference to the Rustenburg Platinum Mines, Limited*—C. B. BEATH, M.I.M.M., M.S.A.Inst.M.M., Consulting Engineer (Coal), Johannesburg Consolidated Investment Company, Limited, with R. J. WESTWOOD, B.Sc.(Eng.)(Lond.), M.Eng.(McGill), A.R.S.M., A.R.I.C., M.I.M.M., M.S.A.Inst.M.M., Consulting Metallurgist, Johannesburg Consolidated Investment Company, Limited and C. A. COUSINS, M.Sc.(Rand), Member of the Geological Society of South Africa, Geophysicist, Johannesburg Consolidated Investment Company, Limited. *Protective Treatments for Mine Timber*—A. L. JAMES, M.A., D.Phil.(Oxon.), Director, Chamber of Mines Biological and Chemical Research Laboratory. *Electric Power Supply to the Mining Industry in the Transvaal and Orange Free State : Its Generation, Transmission and Cost*—W. FENWICK, M.I.E.E., A.A.M.I.E.E., M.(S.A.)I.E.E., Chief of Operations and Maintenance, Electricity Supply Commission and H. M. TORR, B.Com., Assistant Secretary, Electricity Supply Commission. *Some Aspects of Coal Research with Particular Reference to Conditions in the Union of South Africa*—A. J. PETRICK, Dr. Ing., Director, Fuel Research Institute of South Africa. *Coal Mining in South Africa*—A. E. FRASER, M.I.M.E., M. American I.-M.E., M.S.A.Inst.M.M., Consulting Engineer, Rand Mines, Limited.

NORTHERN RHODESIA

1. At Nchanga : *Leaching of Oxide Concentrates at Nchanga*—E. W. PAGE, B.Sc.(Eng.)(Met.), A.M.I.M.M., M. American I.M.E., Metallurgical Superintendent, Nchanga Consolidated Copper Mines Limited. *Changes in Caved Ore Practice at Nchanga*—V. W. HALL, A.C.S.M., A.M.I.-M.M., Underground Manager, Nchanga Consolidated Copper Mines Limited. *A Description of Open Pit Mining at Nchanga*—A. G. MCADAM, B.Sc.(Rand), A.M.I.-M.M., Underground Manager, Nchanga Consolidated Copper Mines Limited and W. HOLT, B.Sc.(Leeds), A.M.I.M.M., Planning Engineer, Nchanga Consolidated Copper Mines Limited.

2. At Mufulira : *Refined Copper Casting at Mufulira*—P. C. LOCKYER, B.Sc., F.I.M., A.M.I.M.M., Refinery Superintendent, Mufulira Copper Mines Limited and R. R. NELLER, A.S.T.C.(Met.), A.A.I.M.E.E., Assistant Refinery Superintendent, Mufulira Copper Mines Limited. *Converter Practice at Mufulira*—D. L. TURNBULL, M.I.M.M., Smelter Superintendent, Mufulira Copper Mines Limited and L. R. VERNY, M.Sc., A.M.I.M.M., Assistant Smelter Superintendent, Mufulira Copper Mines Limited. *Underground Drainage and Sludge Disposal at Mufulira*—D. YOUNG, B.Sc., A.R.S.M., M.I.M.M., M.A.I.M.E., Mine Superintendent, Mufulira Copper Mines Limited and P. B. MATTUSHEK, B.Sc., Resident Engineer, Mufulira Copper Mines Limited. *Description of the 600,000 Tons Per Month Concentrator at Mufulira*—A. A. T. FINN, D.C.M., M.I.M.M., Concentrator Superintendent, Mufulira Copper Mines Limited and A. WIGHTMAN, B.Sc., Ph.D., Assistant Concentrator Superintendent, Mufulira Copper Mines Limited. *Mining Methods at Mufulira*—D. YOUNG, B.Sc., A.R.S.M., M.I.M.M., M.A.I.M.E., Mine Superintendent, Mufulira Copper Mines Limited.

3. At Rhokana: *The Planning and Scheduling of Mindola Sub-Vertical Shaft*—J. L. P. MACKENZIE, B.Sc.(Eng.), A.M.I.-Mech.E., A.M.S.A.I.Mech.E., Project Team Manager, Rhokana Corporation Limited and D. R. T. MYTTON, A.C.S.M., A.M.I.-M.M., Design Engineer (Mining), Rhokana Corporation Limited. *Certain Factors in the Design of Copper Smelting Reverberatory Furnaces*—W. J. DE VILLIERS, Ph.D., B.Sc.(Elec.), B.Sc.(Mech.), Mine Manager, Rhokana Corporation Limited. *Studies of the Performances of Wire-Bar Furnaces at Rhokana*—R. C. BÖHME, B.Sc.(Eng.), M.U.D., Sectional Engineer, Rhokana Corporation Limited. *General Trends in Training for Management with Special Reference to Rhokana*—E. A. B. PHILLIPS, B.A., M.Ed., Personnel Manager, Rhokana Corporation Limited.

4. At Roan Antelope: *Underground Planning*—W. K. BURGESS, A.C.S.M., A.M.I.M.M., Sectional Mine Engineer, Roan Antelope Copper Mines Limited. *Some Aspects of Reverberatory Furnace Foundations*—A. S. WEBSTER, B.Sc., A.M.I.-Mech.E., Mechanical Engineer, Roan Antelope Copper Mines Limited. *Advantages Derived from the Application of the Punched Card System at Roan Antelope Copper Mines*—J. T. HORNIBROOK, Mine Secretary, Roan Antelope Copper Mines Limited.

5. At Broken Hill: *Lead Smelting and Refining at Broken Hill, Northern Rhodesia*—A. J. PERRY, M. Aust.I.M.M., Lead Plant Superintendent, Rhodesia Broken Hill Development Corporation, Limited.

6. At Chibuluma: *Classification of Mill Tailings for Sandfilling and Extraction of Rib Pillars by Cut and Fill at Chibuluma*—B. M. COLLINSON, A.R.S.M., A.M.I.M.M., Underground Manager, Chibuluma Mines, Limited. *Differential Flotation of Copper and Cobalt Minerals at Chibuluma*—J. E. HARPER, A.M.I.M.M., Concentrator Superintendent, Chibuluma Mines, Limited.

7. At Bancroft: *Some Recent Developments in the Mining, Handling and Treatment of Bancroft Ores*—J. POPE, B.Sc., A.M.I.M.M., Assistant Underground Manager, Bancroft Mines Limited with P. B. MARTIN, B.Sc.(Mech.E.), Mechanical Engineer, Bancroft Mines Limited and V. C. WARD, B.Sc.(Met.Eng.), Concentrator Superintendent, Bancroft Mines Limited. *A Mineralogical Approach to Some Copper-belt Metallurgical Problems*—A. E. O'MEARA, B.E., B.Sc., Senior Mineralogist, Rhoanglo Mine Services, Limited.

Among companies exhibiting at the 21st International Geological Congress in Copenhagen, August 15-25, are: AB Elektrisk Malmletning, who will be showing a working model of the ABEM Co.'s airborne electromagnetic prospecting system; The Swedish Diamond Rock Drilling Co., parent company of the Craelius organization, who will have on show, among other equipment, the latest development of the Craelius dip indicator, which can measure the inclination and direction of diamond drill holes down to 3,000 ft.

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Personal

Mr. Richard Miles, who retired as chairman and managing director of Head Wrightson and Co. on January 31 last, has been given a presentation by the board, staff and workers to mark his retirement. Mr. Miles has written a booklet for boys who may be interested in a career in the iron and steel industry. This publication is obtainable from the company.

The Dowty Group announce the appointment of Mr. L. Harper as managing director of Dowty Hydraulic Units. Mr. Harper was formerly managing director of Massey-Ferguson (G.B.).

Mr. David C. Haney has been appointed managing director of International Harvester Co. of Great Britain.

Mr. Chris C. Bleach has been elected president of the South Wales Institute of Engineers for the Session 1960/61, taking office as from July 1.

Mr. Denis J. Martin, general manager of Warman Equipment Pty., is visiting the U.K. during June and July, arriving June 24. His firm in Australia is interested in setting up overseas organizations in association with business already operating in the mining field.

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Aluminium, 99.5%, £186 per ton	Magnesium, 2s. 24d./2s. 3d. lb.
Antimony—	Manganese Metal (96%/98%) £275/£285
English (99%) delivered, 10 cwt. and over £190	Nickel, 99.5% (home trade) £600 per ton
per ton	Osmium, £22/£24 oz. nom.
Arsenic, £400 per ton	Osmiridium, nom.
Bismuth (min. 1 ton lots) 16s. lb. nom.	Palladium, imported, £8 12s. 6d.
Cadmium 10s. 6d. lb.	Platinum U.K. and Empire Refined £30 5s.
Cerium (99%) net, £15 0s. lb. delivered U.K.	Imported £28½/28½
Chromium, Cr. 99% 6s. 11d./7s. 4d. lb.	Quicksilver, £70/£70½ ex-warehouse
Cobalt, 12s. lb.	Rhodium, £45/£48 oz.
Germanium, 99.99% Ge. kilo lots 2s. 5d. per gram	Ruthenium, £16/£18 oz. nom.
Gold, 249s. 10d.	Selenium, 50s. 0d. per lb.
Iridium, £23/£26½ oz. nom.	Silver, 79½d. f. oz. spot and 79½d. f'd
Lanthanum (98%/99%) 15s. per gram.	Tellurium, 25s. 0d. lb.

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Antimony Ore (60%) basis	20s. 0d./21s. 0d. per unit, c.i.f.
Beryl (min. 10 per cent BeO)	210s./220s. per l. ton unit BeO
Bismuth	65% 8s. 6d. lb. c.i.f.
	18/20% 1s. 3d. lb. c.i.f.
Chrome Ore—	
Rhodesian Metallurgical (semifriable 48%) (Ratio 3 : 1)	£15 5s. 0d. per ton c.i.f.
Hard Lumpy 45% (Ratio 3 : 1)	£15 10s. 0d. per ton c.i.f.
Refractory 40%	£11 0s. 0d. per ton c.i.f.
Smalls 44% (Ratio 3 : 1)	£13 5s. 0d. per ton c.i.f.
Baluchistan 48% (Ratio 3 : 1)	£11 15s. 0d. per ton f.o.b.
Columbite, Nigerian quality, basis 70% combined pentoxides (Ratio 10 : 1)	
Nb ₂ O ₅ : Ta ₂ O ₅	175s./180s. per l. ton unit c.i.f.
Fluorspar—	
Acid Grade, Flotated Material	£22 13s. 3d. per ton ex. works
Metallurgical (75/80% CaF ₂)	156s. 0d. ex. works
Lithium Ore—	
Petalite min. 34% Li ₂ O	47s. 6d./52s. 6d. per unit f.o.b. Beira
Lepidolite min. 34% Li ₂ O	47s. 6d./52s. 6d. per unit f.o.b. Beira
Amblygonite basis 7% Li ₂ O	75s./85s. per ton f.o.b. Beira
Magnesite, ground calcined	£28 0s./£30 0s. d/d
Magnesite Raw (ground)	£21 0s./£23 0s. d/d
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Europe (46%-48%) basis 67s. 6d. freight	73d./75d. c.i.f. nom.
Manganese Ore (43%-45%)	69d./71d. c.i.f. nom.
Manganese Ore (38%-40%)	nom.
Molybdenite (85%) basis	8s. 11d. per lb. (f.o.b.)
Titanium Ore—	
Rutile 95/97% TiO ₂ (prompt delivery)	£28 0s. 0d. per ton c.i.f. Aust'n.
Ilmenite 50/52% TiO ₂	£11 10s. per ton c.i.f. Malayan
Wolfram and Scheelite (65%)	156s./162s. per unit c.i.f.
Vanadium—	
Fused oxide 95% V ₂ O ₅	8s./8s. 11d. per lb. V ₂ O ₅ c.i.f.
Zircon Sand (Australian) 65-66% ZrO ₂	£16/£16 10s. ton c.i.f.

Sutcliffe

schemes for underground movement



extend to the surface

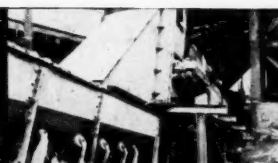
From face to pit bottom—from pit top to the washery and storage bunkers—for dirt disposal, Richard Sutcliffe Ltd, supply all the necessary equipment for the movement of coal and dirt. Some of our recent developments and installations are illustrated here.

We are still pioneering; if your need is a complete handling scheme or merely some replacement idlers, both quality and service are assured when you specify Sutcliffe. May we send you publication MJ/79 which deals with our latest equipment.

Sutcliffe

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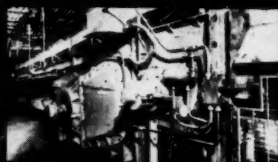
Skip discharge equipment



Hydraulically driven Armadillo



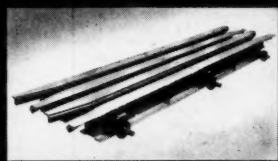
Bunker Conveyor



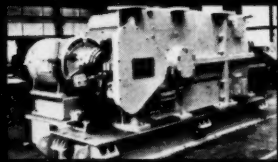
Automatic hydraulic loop take-up



Stable hole conveyor



Tub handling equipment



The "Two Hundred" driving head



Dirt disposal equipment

8, 1960



Road,